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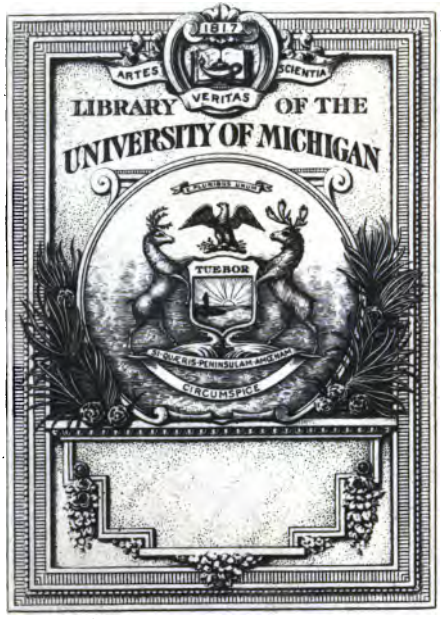

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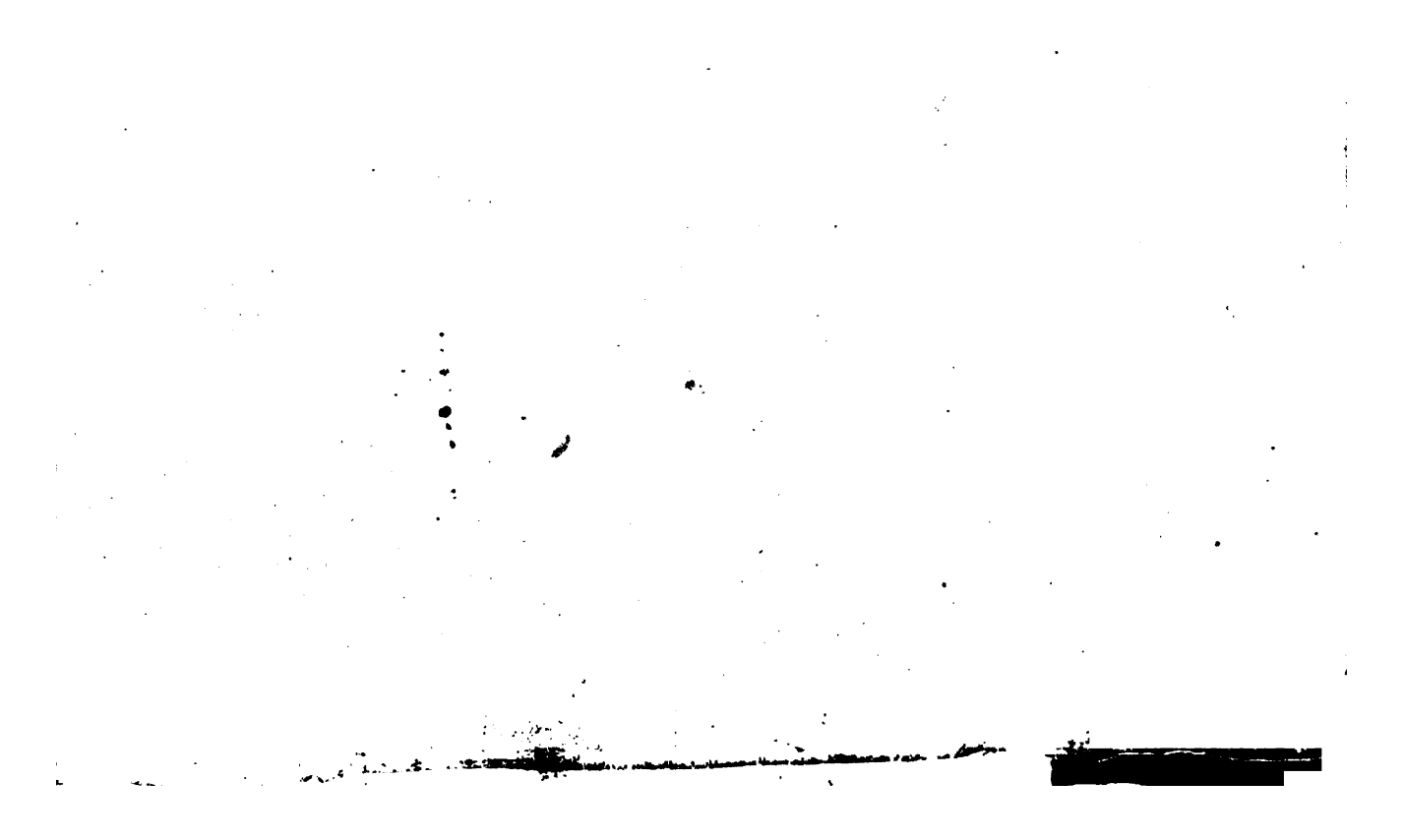

STEREOTYPE EDITION.

THE

SCHOLAR'S ARITHMETIC,

DESIGNED

FOR THE USE OF SCHOOLS

IN THE

UNITED STATES.

BY JACOB WILLETTS,
Author of "*An Easy Grammar of Geography*," &c. &c.

FOURTH EDITION,
CORRECTED AND IMPROVED.

STEREOTYPED BY H. WALLIS, NEW-YORK.

POUGHKEEPSIE:

PRINTED AND PUBLISHED BY PARACLETE POTTER,
FOR HIMSELF, AND FOR S. POTTER & CO. NO. 87
CHESNUT-STREET, PHILADELPHIA.—SOLD ALSO,
BY ALL THE PRINCIPAL BOOKSELLERS
IN THE UNITED STATES.

.....

1822.

OF NEW-YORK, ss.

BE IT REMEMBERED, that on the twenty-fourth day of February in the [illegible] year of the Independence of the United States of America, [illegible] of the said District, has deposited in this office the [illegible]ook the right whereof he claims as proprietor in the words

[illegible]ne Scholar's Arithmetic, for the use of Schools in the [illegible]nited States. By Jacob Willetts."

In conformity to the Act of the Congress of the United States, entitled "An act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the time therein mentioned." And also to an Act, entitled "an Act, supplementary to an Act, entitled an Act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints."

THERON RUDD.
Clerk of the Southern District of New-York.

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A great [illegible] different parts of the [illegible] ly to its utility. But the [illegible] places his principal reliance, as giv[illegible] over any other work of the kind, is the [illegible] duced on the different rules. These qu[illegible] cannot fail to be of important service in giving [illegible] understanding of the different rules. Indeed it is [illegible] method hitherto devised, is so effectual for making the scho[illegible] thoroughly master of his studies, as that of requiring him to answ[illegible] questions embracing all the important particulars of what he [illegible] been learning. Experience has proved the utility of this method [illegible] the study of Geography, and the compiler of the following work [illegible] sanguine in the belief, that it will not only be found equally us[illegible] in conducting learners to a knowledge of Arithmetic, but that it [illegible] dvantageously introduced into most other studies.

[illegible]eat care has been taken throughout the whole work, so to ac[illegible] mode of instruction and the course of business in the Un[illegible] to make it particularly useful to American schools.

[illegible] these remarks, the compiler submits his work to the judgm[illegible] ow-citizens. All he presumes to ask for it, is, that no[illegible] ll pass sentence upon it, until he has given it a candid examina[illegible]

ECHANIC, Dutchess County, 2d Mo. 1822.

ADVERTISEMENT

TO THE

Stereotype Edition.

This work having gone through three editions, and been introduced into many respectable Seminaries in most parts of the United States, the Publisher and Proprietor of the copy right, has been induced, after it had undergone a careful revision, to have it Stereotyped, for the purpose of insuring to all future editions, that entire correctness which is so essential in all elementary books, and especially in Arithmetics. He has been the more induced to this measure, from the circumstance, that the third edition, although corrected with much care, was still found to be disfigured with numerous errors.

February, 1822.

EXPLANATION OF CHARACTERS.

Signs.	Significations.
=	Equal; as 20s. = £1.
+	more; as 6+2=8.
—	less; as 8—2=6.
×	into, with or multiplied by; as 6×2=12.
÷	by (i. e. divided by) as 6÷2=3; or 2)6(3.
: :: :	proportionably; as 2 : 4 : : 6 : 12.
$\sqrt{}^{2}$ or $\sqrt{}$	square root; as $\sqrt{64}=8$.
$\sqrt{}^{3}$	cube root; as $\sqrt[3]{64}=4$.
———	A Vinculum: denoting that the several quantities over which it is drawn, are to be considered jointly as a single quantity.

ARITHMETIC.

Arithmetic is the art of computing by numbers.

It has five principal rules for its operation; viz. Numeration, Addition, Subtraction, Multiplication, and Division.

NUMERATION.

Numeration teaches to express numbers by figures, and consists of two parts, viz.

First, The right placing of figures.

Second, The true valuing of each figure in its proper place, as in the following

TABLES.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	
								1	One
							2	1	Twenty one
						3	2	1	Three Hundred and twenty-one
					4	3	2	1	4 thousand 321
				5	4	3	2	1	54 thousand 321
			6	5	4	3	2	1	654 thousand 321
		7	6	5	4	3	2	1	7 million 654 thousand 321
	8	7	6	5	4	3	2	1	87 million 654 thousand 321
9	8	7	6	5	4	3	2	1	987 million 654 thousand 321
							1	0	Ten
						1	0	5	One hundred and five
					1	0	0	0	1 Thousand
				1	0	0	4	0	10 Thousand and 40
			1	0	0	0	0	1	100 Thousand and 1
		1	4	0	0	3	0	0	1 Million 400 thousand 300
	1	0	0	8	0	2	0	4	10 Million 80 thousand 204
		3	0	0	6	0	0	0	103 Million 6 thousand
		0	3	0	3	0	1	2	300 Million 303 thousand 12

figures are sufficient to express any number in common use, yet the following may be thought necessary.

Nonillions.	Octillions.	Septillions.	Sextillions.	Quintillions.
857324	162486	437916	374986	423147
Quadrillions.	Trillions.	Billions.	Millions.	Units.
248106	235421	261734	268149	62313

EXAMPLES.

Read the following numbers, or write them in words.

10, 14, 18, 20, 25, 31, 44, 63, 80, 99, 100, 102, 113, 145, 287, 405, 600, 756, 1000, 2010, 3436, 7034, 8004, 10325, 23463, 86703, 50043, 682413, 1324371, 1906312, 9849362, 41031638, 403092639, 244336577.

Write the following numbers in figures.

1. One thousand three hundred and fifteen. *Ans.* 1315.
2. Twenty.
3. Fifty-six.
4. One hundred.
5. One hundred and six.
6. Two hundred and eighty-three.
7. Seven hundred and forty-six.
8. Nine hundred and nine.
9. Five thousand four hundred and eight.
10. Twenty-six thousand eight hundred and twenty-four.
11. Five hundred and forty-five thousand four hundred and ninety.
12. Nine hundred and eight thousand.
13. Six hundred thousand.
14. Thirty thousand and three.
15. One million four hundred and seventy-three thousand six hundred and eighty-nine.
16. Fifteen millions five hundred and two.
17. Seventy-three millions and ten.
18. Nine hundred and thirty-two millions three hundred and forty thousand eight hundred and seventeen.
19. Two hundred millions six thousand and three.

SIMPLE ADDITION.

Addition teaches to collect several numbers into one.

The number formed by adding several numbers together, is called the *amount* or *sum*.

RULE.

1. Place the figures one under another, taking particular care to keep units under units, tens under tens, &c.
2. Begin at the right hand column and add upwards.
3. Set down the sum or amount, if it be less than 10.
4. If it should amount to 10 or more, then set down the right hand figure, and add the left to the next row of figures, and so proceed to the last column.
5. In the last column set down the whole amount.

SIMPLE ADDITION.

PROOF.

Perform the addition downward—or, add the top line to the sum of all the rest; and if right, the total will be equal to the first.

EXAMPLES.

(1)	(2)	(3)
4132	6548	46301
4311	7936	
6123	4695	413508
5121	9547	7404
		23809
19687	28726	
		491022
		444721
		491022

(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2	3	21	46	54	87	57	410
1	2	32	21	36	41	21	343
3	4	20	23	82	42	18	361
1	5	14	24	59	43	35	545

(12)	(13)	(14)	(15)	(16)
432	345	487	4820	5026
174	234	435	5461	3074
384	567	578	3203	1020
265	433	452	4020	4005

(17)	(18)	(19)	(20)
6824	4361	1234	9876
9327	1272	9876	6387
5123	3526	4568	3632
4212	6474	5432	6368

(21)	(22)	(23)	(24)
4697	1238	1261	2312
3246	3160	2314	1231
9702	2184	1276	3766
1094	3146	1324	1998
7460	2167	9676	8196

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(14)	(15)	(16)	(17)
32016004	17259725	64271095	1204376
1834009	8423897	27357087	8514

PROMISCUOUS EXAMPLES.

18. What is the difference between 540313 and 7953?

19. From 108632145 take 341.

20. Take one hundred and fifty-six, from three hundred and renty-five.

21. Subtract fifteen thousand six hundred and four, from sixty ousand.

22. From one million, take nine hundred and ninety-nine thou- nd. *Ans.* 1000.

23. From one million, take one. *Ans.* 999999.

24. From nine hundred and eighty-seven millions take nine ndred and eighty-seven thousand. *Ans.* 986013000.

APPLICATION.

25. Charles has 47 marbles, and John has 30, h[illegible] many has harles more than John? *Ans.* 17.

26. William is seventeen years old, and Henry is nine, how ch older is William than Henry? *Ans.* 8.

27. Edwin has two baskets filled with apples, one has one hun- ed and two in it, the other has but forty-three; how many are there in the larger than in the smaller basket? *Ans.* 59.

28. A person had in the bank $[illegible]0002, and he takes out $1404; many has he left? [illegible]. $8598.

29. A vintner bought 30 casks of Bran[illegible]ntaining 3127 gal- and sold 18 casks, containing 1[illegible] gallons; [illegible] many casks ow many gallons had he left? [illegible]. 12 casks, and 1256 gals.

30. How many [illegible]ars have elapsed since the discovery of Ame- by Christopher Columbus in 1492, to the year 1821? *Ans.* 329 years.

31. Suppose I borrow of my friend for 12 months $2345; [illegible] months I pay him $928; how many months will it be [illegible]e remainder is due, and how many dollars have I then [illegible]im? *Ans.* 7 months. $1417.

SIMPLE MULTIPLICATION.

Multiplication is a short way of performing addition, [illegible] of the following terms:

[illegible]*ltiplicand*, or number to be multiplied.

[illegible]umber by which you multiply,

1. The *Dividend* or number given to be divided.
2. The *Divisor*, or number given to divide by.
3. The *Quotient*, or answer, the number of times the diviso is contained in the dividend.
4. The *Remainder*, or what is left after the work is finished which is always less than the divisor, and of the same name a the dividend.

There are two kinds of Simple Division, viz. Short and Lon Division.

SHORT DIVISION.

Short Division is when the divisor does not exceed 12.

RULE.

1. Place the divisor at the left hand of the dividend.
2. Then see how often the divisor is contained in the first figur or figures of the dividend; under which figure set the result.
3. If any remain, conceive it to be prefixed to the next figur see how often the divisor is contained therein, and so proceed.

PROOF.

Multiply the quotient by the divisor, adding in the remainde if any, and the product will be the dividend.

EXAMPLES.

	Dividend (1)	(2)	(3)
Divisor	2)7346286	3)5112896	2)864
Quotient	3673143	1704298 : 2 Rem.	2)725
	2	3	
Proof	7346286	5112896	

(5)	(6)	(7)
3)7210472	4)62104163	5)970361
		6
		56

(8)	(9)	(10)
6)74830956	7)91430682	8)37846

(11)	(12)	(13)
9)4004881	0172	11)4103

When

SIMPLE DIVISION.

(14)	(15)	(16)
12)64381259	7)59436828	8)73426284

LONG DIVISION.

Long Division is that wherein the divisor exceeds 12.

RULE.

1. Place the dividend and the divisor as in Short Division.
2. Consider how many times the divisor is contained in as any figures of the dividend as are necessary, and place that mber on the right hand of the dividend for the first figure in e quotient.
3. Multiply the divisor by this first figure, and place the pro-ct under the left hand figures of the dividend.
4. Subtract this product from the dividend, and call the dif-rence the first remainder; which must be less than the divisor.
5. Bring down the next figure in the dividend, and place it at e right hand of the remainder.
6. Consider how many times the divisor is contained in this mber, place the figure in the quotient, and proceed as before, l all the figures in the dividend are brought down.

PROOF.

By Multiplication as in Short Division, or by adding the re-ainder and each bottom line in one sum.

EXAMPLES.

Dividend.	Quotient.		320)12864016081(40200050
24)634978(	26457		1280
48	24		
154	105828		640
144	52914		640
109	634968		1608
96	10		1600
137	634978	Proof	81
120			
178			
168			
10	Remainder.		
634978	Proof by		

19.	Divide 742859326	by	51	*Ans.* 14565869	Rem. 7
20.	153598	by	29	5296	14
21.	9870	by	42	235	0
22.	253622	by	422	601	0
23.	4633	by	41		0
24.	92587	by	72		67
25.	40231	by	75		31
26.	137896254	by	72		54
27.	46242	by	252		126
28.	13699840	by	342		4
29.	863256	by	736		664
30.	1893312	by	2076		0
31.	46447786	by	1234		26
32.	4586841	by	3467		0
33.	761858465	by	8465		0
34.	761858465	by	90001		0
35.	119184693	by	38473		33812

CASE 2.

1. When there are cyphers at the right hand of the divisor they must be cut off; also cut off the same number of figures from the dividend, and then proceed as before.

2. But the figures which were cut off from the dividend must be placed at the right hand of the remainder.

EXAMPLES.

36. Divide 146340 by 5400 *Ans.* 27 Rem. 540

54]00)1463[40(27
108

383
378

540

37.	Divide 76173	by	320	*Ans.* 238	Rem. 13
38.	3794326	by	6500		4826
39.	421407256	by	49000		7256
40.	4673625	by	21400		8425
41.	7649580	by	100		80
42.	654347230	by	901000		221230
43.	763753	by	1000		753

CASE 3.

When the divisor is such a number, that any two figures in the

multiplication table, being multiplied together will produce it, divide the given dividend by one of those figures, and the quotient thence arising by the other, and the last quotient will be the answer.

Note. The total remainder is found by multiplying the last remainder by the first divisor, and adding in the first remainder.

44. Divide 46508974 by 96 Facit 484468 Rem. 46.

8)46508974

12)5813621 : 6 first Remainder.

484468 : 5 last Remainder.

8 times 12 are 96

8
40
6
46

45.	Divide 20208 by 48	*Ans.*	421	Rem.
46.	467412 by 24		19475	12
47.	937387 by 54		17359	1
48.	145266 by 108		1345	6
49.	1575360 by 144		10940	0

SUPPLEMENT TO MULTIPLICATION.

To multiply by a mixt number; that is a whole number joined with a fraction as $4\frac{1}{2}$, $5\frac{3}{4}$, $6\frac{1}{4}$, &c.

RULE.

Multiply by the whole number, and take $\frac{1}{2}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$, &c. of the multiplicand, and add it to the product;—Or multiply the upper number of the fraction, and divide its product by the under one, and the result will be the value of the fraction.

EXAMPLES.

50. Multiply 26 by $5\frac{1}{2}$

2)26

$5\frac{1}{2}$

13 = $\frac{1}{2}$ of 26
130

143 *Ans.*

51. Multiply 48 by $14\frac{3}{4}$

2)48

$14\frac{3}{4}$

2)24 = $\frac{1}{2}$ of 48
12 = $\frac{1}{4}$ of 48 or $\frac{1}{2}$ of 24
192
48

708 *Ans.*

52.	Multiply	16	by $6\frac{1}{2}$	- - -	*Ans.*	104
53.		204	by $18\frac{1}{2}$	- - -	-	3774
54.		8	by $4\frac{3}{4}$	- - -	-	38
55.		126	by $8\frac{1}{5}$	- - -	-	$1033\frac{1}{5}$
56.		58	by $40\frac{1}{2}$	- - -	-	2349
57.		824	by $6\frac{3}{4}$	- - -	-	5562
58.		36	by $\frac{3}{4}$	- - -	-	27

APPLICATION TO DIVISION.

59. How many 4's are there in 320? *Ans.* 80.

60. A man intending to go a journey of 3264 miles would wish to perform it in 136 days, how many miles must he travel each day? *Ans.* 24 miles.

61. If a man's board cost him 72 shillings for a month, or 4 weeks, how much does he pay for each week? *Ans.* 18*s.*

62. Several boys went to gather nuts, and collected 4275, which when shared among them, each had 855; how many boys were in company? *Ans.* 5 boys.

63. A farm of 375 acres is let for 1125 dollars, how much does it pay an acre? *Ans.* 3 dollars.

64. Suppose a man's income to be 2555 dollars a year; how much is that per day, there being 365 days in a year? *Ans.* 7 dollars.

Questions to exercise the learner in Addition, Subtraction, Multiplication, and Division.

65. If I add 167, 394, and 447, and divide their amount by 12, what number will result? *Ans.* 84.

66. Deborah bought 24 peaches: she kept 14 of them herself, and divided the rest equally between her two little sisters: how many had each? *Ans* 5.

67. Admitting a man has a farm containing 200 acres, which is divided into plough land, pasture, meadow, and wood land; he has 50 acres of wood, 25 of meadow, 60 of pasture; how many acres were there left for plough land? *Ans.* 65.

68. Suppose 2072 apple trees be planted in 14 rows; how many will there be in each row, and how many bushels of apples will the orchard bear, admitting each tree to have 12 bushels on it?

Ans. 148 trees, and 24864 bushels.

69. A man at his decease, left property, amounting to £12426. directed in his will that £1000 should be given to his niece; that the remainder of the property should be divided, equally, ween his two nephews. What is the share of each nephew?

Ans. £5713.

70. To find how many dollars are contained in any number of pounds, we multiply the pounds by $2\frac{1}{2}$. How many dollars are here in £846? *Ans* $2115.

71. There are 16 bags of coffee, weighing each 120 pounds, and 8 bags weighing each 343 pounds. What is the weight of the whole? *Ans.* 4664.

QUESTIONS IN NUMERATION.

What is Arithmetic?
How many principal rules are there in Arithmetic?
What are they called?
What does numeration teach?
Of what does it consist?
When several figures are set down together, which are the units, which the tens, which the hundreds, &c.

QUESTIONS IN ADDITION.

What does addition teach?
What is the amount or sum?
How should we place figures to be added, and wherein is particular care necessary?
Where do we begin to add a sum?
When the sum or amount of each column does not exceed nine, what must be done with it?
But if the sum or amount is more than nine, which of the figures is to be set down, and what is to be done with the other?
What is to be observed in setting down the sum of the last column?
How is addition proved?

QUESTIONS IN SUBTRACTION.

What does simple subtraction teach?
In subtraction, what are the greater number, the less one, and the difference called?
How are numbers placed to be subtracted?
Where do we begin to subtract, and how is subtraction performed?
When the lower figure is larger than the one above, what is then to be done?
When the lower figure is taken from 10, what do we do?
How is subtraction proved?

QUESTIONS IN SIMPLE MULTIPLICATION.

What is simple multiplication?
What are the names of the terms in simple multiplication?
Which term is the multiplier?
Which is the multiplicand?
What is the product?
What are the multiplier and multiplicand generally called?

Where must the multiplier be set under the multiplicand?

After placing the multiplier in its proper place, what is to be done with it?

When the product does not exceed 9, what should be done with it?

But if the product exceed 9, which figure must be set down; and what should be done with the other?

What must be done with the last product?

How is multiplication proved?

When the multiplier exceeds 12, or consists of several figures, how must it be placed?

What must be done with each figure of the multiplier, and how must the product of each be placed?

How is the total product found?

When there are cyphers on the right hand of either or both the factors, what must be done with them?

When the multiplier is the exact product of two figures in the multiplication table, how should we proceed to obtain the answer?

QUESTIONS IN SIMPLE DIVISION.

What is division?

What does division teach?

How many principal parts are there belonging to division, and what are they called?

Which is the dividend?

Which is the divisor?

Which the quotient?

Which is the remainder?

What is always observed respecting the remainder?

How many kinds of simple division are there?

What is short division?

How are the divisor and dividend to be placed?

What is the first step taken in short division?

If there be any remainder, what is to be done with it?

How is division proved?

What is long division?

Having placed the divisor and dividend in their proper places, what is first to be considered?

What is to be done with the figure or number that is placed in the quotient?

What is to be done with the product found by multiplying the quotient and divisor together?

What must be prefixed to the remainder?

After having brought down a figure, and placed it in its proper place, what is then to be done?

How is long division proved?

When there are cyphers at the right hand of the divisor, how is the operation generally performed?

What is to be done with those figures which are cut off in the dividend?

When the divisor is the product of any two figures in the multiplication table, how do we proceed?

When we divide thus, and there are remainders, how is the total remainder found?

How do you multiply by a mixt number; that is, a whole number joined with a fraction?

FEDERAL MONEY.

The denominations of Federal money are, Eagle, Dollar, Dime, Cent, and Mill.

10 mills (m) make	1 cent.
10 cents	1 dime.
10 dimes (or 100 cents)	1 dollar, Dol. $
10 dollars	1 eagle.

The relative values of these denominations are precisely the same as those of units, tens, hundreds, &c. For this reason Federal money is added, subtracted, multiplied, and divided by the same rules that are given for Simple Addition, Subtraction, Multiplication, and Division.

It is not customary in reading sums in Federal money to mention eagles or dimes, as the following table will show:

Thousands of dollars	Hundreds of dollars	Eagles, or tens of Dolls.	Dollars	Dimes, or tens of cents	Cents	Mills	
					2	3	2 cents 3 mills
			1	2	3	0	1 dollar 23 cents
		2	4	1	0	5	24 dollars 10 cents 5 mills
	3	6	0	0	8	1	360 dollars 8 cents 1 mill
	6	0	7	2	4	8	607 dollars 24 cents 8 mills
6	0	2	1	4	3	1	6021 dollars 43 cents 1 mill
5	7	8	4	0	0	5	5784 dollars 5 mills

ADDITION OF FEDERAL MONEY.

RULE.

1. Place the sums one under another, with dollars under dollars, cents under cents, and mills under mills.

2 Then add them up, and carry in the same manner as in simple addition, observing to keep the mills, cents, and dollars separate from each other, by placing a point between them.

PROOF.

As in simple addition.

EXAMPLES.

(1) Dols.	cts.	m.	(2) D.	cts.	m.	(3) D.	cts.
349	40	4		18	5	21	14
436	39		4	12	5	56	10
378	94	5	89	06	2	65	75
169	06		2140	00		53	40
7344	76	9	4000	50	3	84	84
$8678	56	8	6233	87	5		

(4) D.	cts.	m.	(5) D.	cts.	m.	(6) D.	cts.	m.
74	38	6	824	30	5		5	0
25	50	2	36	02	1		26	4
21	40	5	413	00	2	1	74	8
216	52	4	764	92	8	21	74	3
515	03	5	174	32	5	86	49	5

7. Add the following sums: 326 dollars; 184 dollars; 1000 dollars; and 83 dollars.

8. Add $45 30 cents: $20 12 cents: $3000 1 cent; and $600 34 cents.

9. Add 4 cents; 12 cents; 83 cents; 16 cents; and 10 cents.

10. Add $1 12 cents 5 mills; 18 cents 7 mills; $2 36 cents, and $11 8 cents 3 mills.

11. Add $342 83 cents 5 mills; 86 cents; $143; $1 5 mills $101 6 cents. *Ans.* $588 76 cts. 0m.

APPLICATION.

12. Bought a hat for $5; a vest for $3 50 cents; a coat for $15 50 cents; a pair of boots for $8 50 cents. What is the cost of the whole? *Ans.* $32 50 cents.

13. Admit a bond of $3420 64 cents is due me, and the interest on it is $100 dollars 49 cents, what is the amount?

Ans. $3521 13 cents.

14. Bought a Spelling book for 25 cents, a Dictionary for $1 12 cents 5 mills, an English Reader for 75 cents, a slate for 31 cents, a pencil for 1 cent, and a penknife for 50 cents; what do they all amount to? *Ans.* $2 94 cents 5m.

15. Suppose I am indebted

To A twenty-seven dollars thirty cents
B sixty dollars, fifty cents, and nine mills
C fifty dollars, ninety-eight cents
D one hundred dollars, seven mills
E seven dollars, four cents and eight mills
F thirty dollars, seventy-five cents
G forty-eight dollars, twenty cents
H seventy-three dollars, twenty-seven cents:

How much is the amount of my debts? *Ans.* $398 6cts. 4m.

SUBTRACTION OF FEDERAL MONEY.

RULE.

Place the less sum under the greater, with dollars under dollars, cents under cents, and mills under mills, and then subtract as in whole numbers.

Note.—The dollars, cents and mills must be separated by dots.

EXAMPLES.

(1)	(2)	(3)
Dls. cts.	Dls. cts. m.	Dls. cts. m.
46, 74	43, 21, 5	764,
13, 89	1, 00, 0	8, 24, 5
32, 85	42, 21, 5	755, 75, 5

(4)	(5)	(6)
D. c. m.	D. c. m.	D. c. m.
694, 34, 2	123, 04, 5	5, 34, 8
360, 70, 4	86, 70, 6	1, 54, 2

(7)	(8)	(9)
D. c. m.	D. c.	D. c. m.
66, 41, 3	50, 60	100, 0, 0
13, 14, 2	1,	1

10. Subtract $326 from $1000.
11. Subtract $9 9cts. from $125. *Ans.* $115 91cts.
12. From $127 1ct. take $41 10cts. *Ans.* $85 91cts.
13. From $41 8cts. take $1 9cts. *Ans.* $39 99cts.
14. From $100 take 1 mill. *Ans.* $99 99cts. 9m.
15 From $20 take 20cts. *Ans.* $19 80cts.

APPLICATION.

16. A boy borrowed $2 6cts. and returned 50cts. how much is he in debt? *Ans.* $1 56cts.
17. A merchant bought a quantity of coffee, for which he paid $426. He afterwards sold it for $526 37cts. 5 mills. How much did he make by the sale? *Ans.* $100 37cts. 5m.
18. A miller bought 356 bushels of wheat for $700, and sold 200 bushels for $330 56cts. How many bushels has he on hand, and what does it stand him in? *Ans.* 156 bush. $319 44cts.
19. Sent $4700 to the bank, and having drawn out $1002, how much still remains in? *Ans.* $3698

MULTIPLICATION OF FEDERAL MONEY.

RULE.

Set the multiplier under the sum to be multiplied as in Simple Multiplication, and proceed in the same manner, carefully observing to distinguish by dots the mills, cents, and dollars.

Proof; as in simple multiplication.

EXAMPLES.

(1)	(2)	(3)
D. cts.	D. cts. m.	D. cts. m.
14, 25	324, 21, 5	12, 37, 5
5	6	135
71, 25	1945, 29, 0	61875
		37125
		12375
		1670,62,5

(4)	(5)	(6)	(7)
Dols. cts.	Dols. cts. m.	Dols. cts.	Dols. cts. m.
342 : 12	425 : 13 : 4	203 : 41	87 : 26 : 4
3	5	7	2 8

		Dols.	cts.	m.			Dols.	cts.	m.
8.	Multiply	5000			by	6 Product	30000	: 00	
9.		42	: 28		by	3	126	: 84	
10.		136	: 00	: 5	by	8	1088	: 04	
11.		29	: 50		by	12	354		
12.		300	: 30	: 3	by	14	4204	: 24	: 2
13.		41	: 51	: 8	by	76	3155	: 36	: 8
14.		365	: 14	: 4	by	123	44912	: 71	: 2
15.		29	: 8	: 3	by	138	4013	: 45	: 4

APPLICATION.

1. How much will fourteen dozen eggs come to at 12½ cents a dozen? *Ans.* $1 75 cents.

2. How much will 5 bushels of potatoes come to at 50 cents a bushel? *Ans.* $2 50 cents.

3. What will 8 cords of wood come to at $4 50 cents a cord? *Ans.* $36

4. What cost 94 bushels of oats at 33 cents a bushel? *Ans.* $31 2 cents.

5. Bought 37 oxen for $52 each: what do they come to? *Ans.* $1924.

6. What do 60 firkins of lard come to at $7 14 cents a firkin? *Ans.* $428 40 cents.

7. What cost a farm containing 125 acres at $36 50 cents an acre? *Ans.* $4562 50 cents.

8. Find the amount of the following bill:

Poughkeepsie, 1st Mo. (Jan.) 1st, 1816.

Benjamin Paywell,

Bought of Timothy Merchant,

		$ cents.
28lb. of green tea,	at	2 15 per lb.
41lb. of coffee,	at	0 21
34lb. of loaf sugar,	at	0 19
13 cwt. of Malaga raisins,	at	7 31 per cwt.
35 firkins butter,	at	7 14 per fir.
27 pair of worsted hose,	at	1 04 per pair.
94 bushels of oats,	at	0 33 per bush.
29 pair of men's shoes,	at	1 12 per pair.

Amount $511 78 cts.

Received payment in full.

Timothy Merchant.

DIVISION OF FEDERAL MONEY.

RULE.

1. If the sum to be divided, consist of dollars, cents and mills, divide as in Simple Division.

2. But if there should be only dollars, then set two cyphers in the place of cents, and if you wish mills, then set another cypher for mills.

3. If when the sum is divided, there are cents and mills in the dividend, then point off the first figure on the right hand of the quotient for mills, the next two for cents, and all the remaining ones, if any, will be dollars.

PROOF.

As in simple division.

EXAMPLES.

(1)

Dls. cts.
9)463,64,0
51,51,5,5

(2)

Dls. cts.
4)56,34,1
14,08,5,1

(3)

Dls. cts. Dls.cts.m.
49)6434,49(131,31,6
49
153
147
64
49
154
147
79
49
300
294
6

(4)

Dls.cts.m.
6)342,81,4

(5)

Dls.cts.m.
8)37,38,4

(6)

Dls.cts.m.
4)532,45,3

(7)

Dls.cts.m.
12)87,04,3

8. Divide $56 43cts. by 7 *Ans.* $8 6cts. 1m.+
9. Divide $1724 64cts. by 16
10. Divide $365 24cts. 2m. by 28
11. Divide $186 30cts. 4m. by 38
12. Divide $53 40cts. 9m. by 138
13. Divide $156 50cts. 2m. by 473

APPLICATION.

14. Divide $52 24cts. between 24 persons.
Ans. $2 17cts. +

15. Bought 40 bushels of wheat for $72 34cts. how much is that a bushel? *Ans.* $1 80 cts. 8m. +

16. If a man bought a load of hay for $6 that weighed 15 hundred weight, what was it per cwt.? *Ans.* 40cts.

17. Paid $58 75cts. for 235 yards of muslin. What was it a yard? *Ans.* 25cts.

18. Sold 144 yards of homespun cloth for $90; how much is that a yard? *Ans.* 62cts. 5m.

PROMISCUOUS EXAMPLES IN THE FOREGOING RULES.

Of Federal Money.

19. If I add the following sums, viz. $583 18cts. $8431 6cts. and $20 14cts. and subtract from their amount $1312 14cts. 6m. what sum will remain? *Ans.* $7722 23cts. 3m.

20. If I subtract $125 34cts. from $438 2cts. and multiply the remainder by 4, what will be the result? *Ans.* $12[illegible]72cts.

21. A person hires a house for $250, he pays his tailor $14 73cts. his shoe maker $18, his fire wood cost him $43 18cts. his butcher's bill is $87 40cts. his baker's $59, and by his trade he clears $600 yearly; is he making or losing money?
Ans. Saves $27 69cts.

22. A teacher, who had 48 scholars, distributed equally among of his number, for their diligence, 8 cents a piece; how much money did he give them? *Ans.* $1 28cts.

23. Calculate the amount of articles in the following bill:

Nine Partners, 5th mo. 1816.

J. White

Bought of J. King,

19 yds. of lace,	at	$2 37½cts. per yard
14 do of ribbon	at	18¾——
24 do. do.	at	25 ——
8 pair of gloves	at	27 per pair.
13 fans	at	13 each.
2 pair of knots	at	25 per pair.

Amount $58 16¼cts.

TABLES OF WEIGHTS AND MEASURES, &c.

1. ENGLISH MONEY.

4 Farthings	make 1	Penny	marked qr.	d.
12 Pence		Shilling		s.
20 Shillings		Pound		£

Note—Farthings are marked thus:

$\frac{1}{4}$ one farthing.
$\frac{1}{2}$ two farthings, or halfpenny.
$\frac{3}{4}$ three farthings.

PENCE TABLE.

d.	s.	d.	s.	d.	s.	£	s.
20 =	1 :	8	2 =	24	20 =	1 :	0
30 =	2 :	6	3 =	36	30 =	1 :	10
40 =	3 :	4	4 =	48	40 =	2 :	0
50 =	4 :	2	5 =	60	50 =	2 :	10
60 =	5 :	0	6 =	72	60 =	3 :	0
70 =	5 :	10	7 =	84	70 =	3 :	10
80 =	6 :	8	8 =	96	80 =	4 :	0
90 =	7 :	6	9 =	108	90 =	4 :	10
100 =	8 :	4	10 =	120	100 =	5 :	0
110 =	9 :	2	11 =	132	110 =	5 :	10
120 =	10 :	0	12 =	144	120 =	6 :	0

2. TROY WEIGHT.

24 grains (gr.)	make	1 Penny-weight,	dwt.
20 Penny-weights		1 Ounce,	oz.
12 Ounces		1 Pound,	lb.

Note—By this weight, jewels, gold, silver, and liquors are weighed.

3. AVOIRDUPOIS WEIGHT.

16 drams (dr.)	make	1 ounce,	oz.
16 ounces		1 pound,	lb.
28 pounds		1 qr. of a hund. wt.	qr.
4 qrs. (or 112lb.)		1 hundred weight,	cwt.
20 hundred weight		1 ton,	T.

Note—By this weight are weighed all coarse and drossy goods, grocery wares, and all metals except gold and silver.

4. APOTHECARIES WEIGHT.

20 grains (gr.)	make	1 scruple,	℈
3 scruples		1 dram,	ʒ
8 drams		1 ounce,	℥
12 unces		1 pound,	lb

Note—By this weight apothecaries mix their medicines, but buy and sell by Avoirdupois weight.

5. CLOTH MEASURE.

2¼ inches (in.)	make	1 nail,	na.
4 nails		1 qr. of a yd.	qr.
4 quarters		1 yard,	yd.
3 quarters		1 Ell Flemish,	E. Fl.
5 quarters		1 Ell English,	E. E.
6 quarters		1 Ell French,	E. Fr.

Note—By this measure are measured cloth, tapes, &c.

6. LONG MEASURE.

3 barley corns (bc.)	make	1 inch,	in.
12 inches		1 foot,	ft.
3 feet		1 yard,	yd.
5½ yards, or 16½ ft.		1 rod, perch or pole,	pol.
40 poles, or 220 yds.		1 furlong,	fur.
8 furlongs		1 mile,	m.
3 miles		1 league,	L.
60 geographic, or 69½ statute	miles	1 degree,	deg.
360 degrees		a great circle of the earth.	

Note.—By this measure are measured distances, or any thing where length is considered, without any regard to breadth.

A hand is 4 inches, and is used in measuring the height of horses.

A fathom is 6 feet, and is chiefly used in measuring the depth of water.

A chain contains 100 links, and is 66 feet, or 4 rods.

LAND, OR SQUARE MEASURE.

144 inches (in.)	make	1 foot,	ft.
9 feet		1 yard,	yd.
30¼ yards		1 rod, or perch,	rd.
40 rods or perches		1 rood,	r.
4 roods (or 160 rods)		1 acre,	a.
640 acres		1 mile,	m.

Note.—This measure is used in reckoning the content of land, or of things that have length and breadth.

SOLID, OR CUBIC MEASURE.

1728 inches	make	1 foot	ft.
40 feet of round timber, or 50 feet of hewn timber,		1 ton.	T.
128 feet, or 8 feet long, 4 feet high, and 4 feet wide		1 cord of wood,	C

Note.—This measure is used when things have length, breadth, and depth.

LIQUID MEASURE.

4 gills (gil.)	make	1 pint,	pt.
2 pints		1 quart	qt.
4 quarts		1 gallon,	gal.
31½ gallons		1 barrel,	bar.
63 gallons		1 hogshead,	hhd.
2 hogsheads		1 pipe or butt,	pi. or bt.
2 pipes (or 4 hogsheads)		1 tun	T.

Note.—This measure is used for beer, cider, wine, &c.

DRY MEASURE.

2 pints (pt.)	make 1 quart		qt.
8 quarts	1 peck		pe.
4 pecks	1 bushel		bu.

Note.—This measure is used for grain, fruit, salt, &c.

TIME.

60 seconds (sec.)	make	1 minute,	min.
60 minutes		1 hour,	H.
24 hours		1 day,	D.
7 days		1 week,	W.
4 weeks		1 month	mo.
13 lunar, or 12 calendar months		1 year,	yr.
52 weeks, 1 day, and 6 hours, or 365 days and 6 hours		1 year.	

Note.—By the calendar the year is divided in the following manner:

1	Month, January,	hath 31 days,
2	February	28
3	March,	31
4	April,	30
5	May,	31
6	June,	30
7	July,	31
8	August,	31
9	September,	30
10	October,	31
11	November,	30
12	December,	31

Or, Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Except February alone,
Which hath four and twenty-four,
And every fourth year one day more.

Note.—The six hours in each year are not reckoned till they amount to one day: hence, a common year consists of 365 days, and every fourth, called leap year, of 366 days.

When the year can be divided by 4, without any remainder, it is then leap year, in which 2d month (February) has 29 days.

The fourth, eleventh, ninth, and sixth,
Have thirty days to each affix'd,
And every other thirty-one,
Except the second month alone,
Which has but twenty-eight, in fine.
Till leap year gives it twenty-nine.

CIRCULAR MOTION.

60 seconds (″)	make	1 minute,	′
60 minutes		1 degree,	°
30 degrees		1 sign,	S
12 signs, or 360 degrees		1 great circle of the horizon.	

Note.—This table is used by astronomers, navigators, &c.

COMPOUND ADDITION.

Compound Addition teaches to add together several sums or quantities of different denominations.

RULE.

1. Place the numbers of the same denomination under each other and separate the different denominations by a space or by dots.

2. Then begin at the right hand column, and add up as in simple addition: divide the amount by as many of that denomination as will make one of the next greater, set down the remainder (if any) under said column, and carry the quotient to the next, which must be added up and divided in the same manner; and so proceed through all the denominations.

PROOF.

The same as in Simple Addition.

ENGLISH MONEY.

(1) (20) (12) (4)

£	s.	d.	qrs.
487	13	8	3
512	06	4	1
671	14	3	1
764	18	10	3
2436	13	3	1
1948	19	6	1
2436	13	3	1

(2)

£	s.	d.
84	14	9
14	5	7
89	11	8
14	19	9

sum of shil. 20)53(2 — 40 — 13

sum of pence 12)27(2 — 24 — 3

sum of farth. 4)9(2 — 8 — 1

(3)

£	s.	d.
61	13	5
76	14	11
86	3	9
95	17	6

(4)

£	s.	d.	qrs.
47	17	6	1
3	9	10	3
59	17	11	1
317	16	9	3
764	18	10	1
407	17	6	

(5)

£	s.	d.
7	17	10
60	6	8
14	14	11
3	18	0
98	14	5
34	0	3

(5)

£	s.	l.
541	0	0
711	9	8
916	3	5
140	5	10
374	8	5
300	5	6

7. Add £35 12s. 2d.; £66 13s.; £352 17s.; and £2 19s. 2½d.

8. Add £145; £72 0s. 8d; £15 9s. 8½d, 18s. 5¾; and £43 2s. 3¾d.

TROY WEIGHT.

(9)

lb.	oz.	dwt.	gr.
7	10	11	15
2	1	8	9
4	6	7	12
5	5	12	12
9	11	13	14

(10)

lb.	oz.	dwt.	gr.
21	4	13	16
78	7	6	8
36	5	10	14
63	6	9	10
78	9	18	23

11. Add 2lb. 11oz. 10dwt. 2gr.; 15lb. 10oz. 2dwt.; and 145lb. 2oz. 2dwt.

12. Add 14lb. 3oz.; 3lb. 0oz. 13dwt.; 16lb. 5oz. 14dwt.; and 25lb. 6oz.

AVOIRDUPOIS WEIGHT.

(13)

T.	cwt.	qr.
40	11	3
16	10	2
18	0	1
9	12	0
4	3	2

Cwt.	qr.	(14) lb.	oz.	dr.
8	3	12	15	8
12	1	4	3	6
84	2	16	0	5
41	3	25	8	14
	2	4	5	6

15. Add 30 tons, 2 hundred weight, 2 quarters; 13 tons, 2 quarters; and 3 tons, 15 hundred weight.

16. Add 13 hundred weight, 3 quarters, 27 pounds; 17 hundred weight, 10 pounds; and 1 hundred weight, 15 pounds.

APOTHECARIES WEIGHT.

(17)

lb	℥	ʒ	℈	gr.
35	9	4	2	15
42	5	6	1	11
17	10	7	0	3
25	7	3	2	18
84	9	2	1	12

(18)

lb	℥	ʒ	℈	gr.
4	3	2	1	16
14	11	7	2	14
	1	1	2	3
	5	4	1	16
			2	17

19. Add 11 pounds, 7 drams, 1 scruple; 15 pounds, 10 ounces, 2 drams; 54 pounds, 4 ounces; and 46 pounds, 2 scruples.

20. Add 15 pounds, 9 ounces; 1 pound, 12 grains; 8 ounces 7 drams, 2 scruples; and 4 drams 12 grains.

CLOTH MEASURE.

(21)

Yd.	qr.	na.
17	1	1
11	3	1
46	1	2
19	3	1
12	3	3

(22)

E. E.	qr.	na.
14	1	2
17	3	1
14	4	1
16	3	2
19	1	1

(23)

E. Fl.	qr.	na.
17	1	2
17	1	3
14	1	2
16	2	0
14	0	0

24. Add 15 yards, 3 quarters, 2 nails; 45 yards, 2 quarters; 1 yard, 3 nails; and 125 yards.

25. Add 14 English ells, 3 quarters; 25 English ells, 2 quarters, 3 nails; and 3 quarters, 1 nail.

LONG MEASURE.

(26)

Yd.	ft.	in.
4	2	11
3	1	8
1	2	9
6	2	10
1	0	6

(27

Le.	m.	fur.	pol.
86	2	6	32
52	1	7	16
64	2	5	19
73	1	4	15
7	2	3	10

28. Add 13 leagues, 2 miles, 6 furlongs ; 4 leagues, 4 furlongs, 32 poles ; 1 league, 2 miles, 18 poles ; and 20 leagues.

29. Add 2 yards, 1 foot, 9 inches ; 1 yard, 11 inches ; 1 foot, 6 inches ; and 10 yards 5 inches.

LAND MEASURE.

(30)

A.	r.	p.
150	3	39
265	2	12
173	1	14
3	3	0
16	2	5

(31)

Yd.	ft.
8	5
10	1
15	4
16	1
8	8

32. Add 125 acres, 3 roods ; 401 acres, 2 roods, 28 perches 56 acres, 20 perches ; 540 acres.

33. Add 15 yards, 6 feet ; 2 yards, 7 feet ; 16 yards, 2 feet, and 28 yards.

SOLID OR CUBIC MEASURE.

(34)

Ton.	ft.	in.
29	36	1229
12	19	964
18	2	1347
19	8	164
6	3	58

(35)

Cord.	ft.	in.
27	119	1015
19	110	159
48	127	1071
8	111	956
3	26	45

36. Add 36 tons, 45 feet ; 36 feet ; 1 foot, 1641 inches ; and 32 feet, 945 inches.

37. Add 75 cords, 94 feet, 1172 inches ; 364 cords, 74 feet, 246 inches ; 49 feet, 812 inches ; and 113 cords.

LIQUID MEASURE.

(38)

T.	hhd.	gal.	qt.
13	3	15	3
11	2	13	1
24	1	7	2
21	3	3	0
13	1	1	1

(39)

Gal.	qt.	pt.
25	2	0
15	1	0
6	3	0
8	1	1
6	2	0

40. Add 11 tuns, 3 hogsheads, 16 gallons ; 4 tuns, 2 hogsheads, 9 gallons ; 2 hogsheads, 40 gallons ; and 14 tuns.

41. Add 14 gallons, 3 quarts, 1 pint ; 25 gallons, 2 quarts ; 2 gallons, 1 pint ; and 23 gallons.

DRY MEASURE.

(42)

bu.	p.	qt.
10	3	2
118	2	3
216	2	4
450	3	2
111	1	1

(43)

bu.	p.	qt.	pt.
36	1	1	1
49	2	2	1
50	3	6	0
17	2	3	1
46	0	0	0

44. Add 116 bushels, 3 pecks, 6 quarts ; 341 bushels, 1 peck ; 40 bushels, 6 quarts ; and 375 bushels.

45. Add 3 bushels, 3 pecks, 4 quarts, 1 pint ; 6 bushels, 1 peck, 2 quarts ; and 1 peck, 5 quarts, 1 pint.

TIME.

(46)

w.	d.	h.	min.
2	1	10	30
1	6	9	36
3	5	22	45
2	3	6	14
3	1	1	16

(47)

d.	h.	min.	sec.
4	20	56	54
3	17	20	28
2	8	0	3
	7	5	14
		6	5

48. Add 20 years, 4 months ; 45 years, 6 months ; 81 years, 10 months ; 16 years ; and 100 years.

49. Add 6 weeks, 1 day, 5 hours, 45 minutes ; 3 weeks, 4 days, 20 hours ; 3 days, 18 hours, 14 minutes ; and 8 hours.

MOTION.

(50)

°	′	″
71	13	14
12	14	45
83	6	4
17	10	11
36	5	0

(51)

S	°	′	″
5	20	13	47
1	10	12	36
17	5	18	14
3	11	7	9
5	5	0	50

PROMISCUOUS EXAMPLES.

52. Bought a Geography for 8s. 6d.½; an English Reader for 6s. 8d.; an Arithmetic for 4s. 6d.; a slate for 2s. 6d.; and a pen-knife for 3s. 6d.½; what do they all come to? *Ans.* £1 5s. 9d.

53. Bought, of a silversmith, dishes, weighing 16lb. 10oz. 13dwt.; plates, weighing 35lb. 10 oz. 11dwt.; and tea-spoons, 2lb. 10oz.; what was the weight of the whole?

Ans. 55lb. 7oz. 4dwt.

54. Bought 3 hogsheads of sugar, weighing as follows; viz. No. 1, 9cwt. 2qr. 18lb.; No. 2, 8cwt. 3qr. 12lb.; No. 3, 7cwt. 2qr. 19lb; how much is the amount? *Ans.* 26cwt. 0qr. 21lb.

55. Admit a man travelled in one day, 27 miles 2 furlongs; in another 32 miles 7 furlongs, 33 perches; in another 19 miles, 7 furlongs, 16 perches; and in another 12 miles, 5 furlongs; how far did he travel in all? *Ans.* 92m. 6fur. 9 perches.

56. A landlord has 4 farms; the first contains 120 acres, 3 roods; the second, 150 acres; the third 215 acres, 1 rood; and the fourth 96 acres, 2 roods, 20 perches; how many acres are there in all? *Ans.* 582A. 2R. 20P.

57. A person was born in New-York; he lived in that place until he was 18 years and three weeks old; he then went to New-Haven, spending 2 days on the road; he resided there 3 years and 6 months; and then moved to Hartford, he was but 1 day on the road; he remained in Hartford 1 year 2 months and 3 weeks; and then moved to Albany, being 5 days in travelling thither; he has been in Albany 12 years and six days; what will be his age in 2 weeks from this time? *Ans.* 34y. 10m 2w.

COMPOUND SUBTRACTION.

Compound Subtraction teaches to take one quantity of several denominations from a greater of like quality.

RULE.

1. Place the less quantity under the greater, with similar denominations under each other.

2. Begin at the right hand and take the under from the upper.

3. When the lower number is greater than the upper, take it from as many of that denomination as will make one of the next greater, and to the remainder add the upper number, set down the result, and carry one to the next.

PROOF.

Add the remainder to the less number.

ENGLISH MONEY.

EXAMPLES.

(1)

	£.	s. (20)	d. (12)(4)
From	153	17	6 $\frac{1}{4}$
Take	121	13	10 $\frac{3}{4}$
	£32	3	7 $\frac{1}{2}$

(2)

£.	s.	d.
45	8	5 $\frac{3}{4}$
21	3	7 $\frac{1}{4}$

(3)

£.	s.	d.
185	9	5 $\frac{1}{2}$
73	15	4 $\frac{3}{4}$

(4)

£.	s.	d.
18	16	3 $\frac{1}{4}$
6	5	7 $\frac{3}{4}$

(5)

£.	s.	d.
30	0	0
8	16	5 $\frac{3}{4}$

(6)

£.	s.	d.
1000	0	0
		$\frac{3}{4}$

7. Subtract 8000 pounds, 14 shillings; from 10000 pounds, 18 shillings, and 6$\frac{3}{4}$ pence.

8. From 86 pounds; take 1 shilling.

TROY WEIGHT.

(9)

	lb.	oz.	dwt.	gr.
From	27	0	11	10
Take	9	8	1	18
Rem.				

(10)

lb.	oz.	dwt.	gr.
48	10	6	17
19	9	19	21

11. Subtract 18 pounds, 6 ounces; from 125 pounds, 4 ounces, 16 pennyweights.

12. Subtract 1 pound, 3 ounces, 10 pennyweights, 16 grains; from 15 pounds, 3 grains.

AVOIRDUPOIS WEIGHT.

(13)

	T.	C.	qr.	lb.
From	52	12	3	15
Take	24	14	2	26
Rem.				

(14)

C.	qr.	lb.	oz.	dr.
17	1	12	14	15
6	3	21	15	9

15. Subtract 76 tons, 18cwt. 3 quarters; from 183 tons, 1cwt. 3 quarters.

16. Subtract 15 pounds, 4 ounces, 6 rams; from 20 pounds, 2 ounces.

APOTHECARIES WEIGHT.

(17)

lb	℥	ʒ	℈	gr.
9	1	2	2	12
6	10	1	1	19

(18)

lb	℥	ʒ	℈	gr.
28	10	4	1	10
17	6	7	2	8

19. Subtract 16 pounds, 5 ounces, 6 drams; from 24 pounds, 10 ounces, 3 drams.

20. Take 3 ounces, 2 drams, 1 scruple; from 8 pounds, 6 ounces, 1 dram, 4 grains.

CLOTH MEASURE.

(21)

Yd.	qr.	n.
47	1	0
35	2	2

(22)

E.E.	qr.	n.
42	0	3
16	3	1

(23)

E.F.	qr.	n.
71	1	1
67	2	0

24. Subtract 95 yards, 3 quarters, 2 nails; from 137 yards, 3 quarters, 3 nails.

25. Subtract 12 English ells, 2 quarters, 1 nail; from 83 English ells, 1 quarter, 2 nails.

LONG MEASURE.

(26)

L.	m.	fur.	p.
37	0	2	19
16	1	3	13

(27)

yd.	ft.	in.
6	2	5
3	2	8

28. Subtract 43 miles, 5 furlongs, 22 poles; from 420 miles, 3 furlongs, 25 poles.

29. Subtract 15 yards, 1 foot, 3 inches; from 37 yards 8 inches.

LAND MEASURE.

(30)

A.	R.	P.
192	2	2
24	3	2

(31)

A.	R.	P.
25	2	1
3	1	19

32. Subtract 32 acres, 2 roods; from 800 acres, 1 rood, 16 perches.

33. Subtract 83 acres; from 365 acres, 1 rood, 30 perches.

SOLID OR CUBIC MEASURE.

(34)

Tons.	ft.	in.
29	36	1229
12	42	64

(35)

Cords.	ft.	in.
27	110	123
9	119	1015

36. Subtract 13 tons, 15 feet; from 30 tons, 8 ft. 127 inches.

37. Subtract 18 cords, 8 feet, 1119 inches; from 183 cords, 2 feet, 137 inches.

LIQUID MEASURE.

(38)

Tuns.	hhd.	gal.	qt.
35	3	45	2
17	1	60	3

(39)

Gal.	qt.	pt.
76	3	1
22	1	0

40. Subtract 14 tuns, 3 hogsheads, 10 gallons; from 30 tuns, 2 hogsheads, 12 gallons.

41. From 85 hogsheads, 13 gallons, 3 quarts, 1 pint; take 21 hogsheads, 2 quarts.

DRY MEASURE.

(42)

Bu.	pe.	qt.
98	3	1
41	0	2

(43)

Pe.	qt.	pt.
4	6	0
2	7	1

44. Subtract 123 bushels, 2 pecks, 1 quart; from 173 bushels.

45. Subtract 321 bushels; from 601 bushels, 2 pecks.

TIME.

(46)

Yr.	mo.	w.	d.	h.
83	3	3	6	21
21	8	1	4	22

(47)

D.	h.	min.	sec.
83	13	30	25
15	17	21	34

48. Subtract 125 years, 9 months; from 365 years 6 months.

49. Take 131 days, 18 hours, 30 minutes; from 201 days, 19 hours.

MOTION.

(50)

S.	°	′	″
9	23	45	54
3	7	40	56

(51)

S.	°	′	″
9	29	34	54
6	29	40	36

APPLICATION.

52. If a person buy a quantity of wheat for £1893 ¾qr.; and sell the same for £2000; how much will he make by the sale?

Ans. £106 19s. 11¼d.

53. A silversmith had 34 pounds, 9 ounces, 10 pennyweights of silver; he melts 19 pounds, 15 pennyweights, 10 grains; how much has he left? *Ans.* 15lb. 8oz. 14dwt. 14gr.

54. If out of 6 pounds, 10 ounces, 6 drams, 2 scruples, of medicine, be taken 4 pounds, 5 ounces, 4 drams, 1 scruple, 17 grains; what quantity will remain? *Ans.* 2℔. 5℥. 2ʒ. 0℈. 3gr.

55. The distance from Albany to Hudson is about 30 miles, 1 furlong, and 15 poles. A person going from one place to the other, stopped at an inn, when he had travelled 18 miles, 3 furlongs, and 30 poles; how much farther has he still to go?

Ans. 11 miles, 5 fur. 25 poles.

56. Bought 145 yards, 3 quarters of cloth, and sold thereof 95 yards, 2 quarters, 3 nails; how much remains?

Ans. 50yd. 1na.

57. A farmer had 500 acres, 1 rood of land; one of his sons having married, he gave him 150 acres, 3 roods, 25 perches; how much had he remaining?

Ans. 349 acres, 1 rood, 15 perches.

58. Bought several casks of cider, containing 154 gallons, 2 quarts; and disposed of one which contained 41 gallons, 2 quarts, 1 pint; how much is there in the other casks?

Ans. 112 gals. 3 qt. 1 pt.

59. Out of a granary which contained 283 bushels of corn, there was taken 153 bushels, 2 pecks, 5 quarts; what quantity remains? *Ans.* 129 bush. 1 peck, 3 qt.

60. William was bound as an apprentice for 7 years. He has served 3 years and five months; how long has he still to serve?

Ans. 3 years 7 months.

61. Henry was born on the 20th of 8th mo. (Aug.) 1789, and Charles on the 18th of 9th mo. (Sept.) 1808 ; what is the difference of their ages ? *Ans.* 19y. 29 days.

62. A bond was given 21st of 5th month (May) 1809, and was taken up the 12th of 3d month (March) 1815 ; what time elapsed from the day the bond was given, till the day it was taken up ?

Ans. 5 years, 9 mo. 22 days.

Note.—The interval or space of time between two given dates is thus found : Set the prior date under the subsequent date ; and when the lower number of days is greater than the upper, take it from as many days as are in the month of the prior date, add the difference to the upper number, and set down the amount : then carry 1 to the months of the prior date, and subtract as in the foregoing examples.

COMPOUND MULTIPLICATION.

Compound Multiplication teaches to multiply numbers or quantities, consisting of divers denominations)

CASE 1.

When the multiplier does not exceed 12.

RULE.

1. Place the multiplier under the lowest denomination of the given quantity.

2. Multiply each denomination of the given sum by the multiplier ; if the product be not equal to the next higher denomination, set it down.

3. But if the product be equal to, or more than the next higher denomination, then divide it by as many of that denomination as will make one of the next, set down the remainder, (if any) and add the quotient to the product of the next denomination ; and so proceed.

EXAMPLES.

(1)

(20)	(12)(4)	Prod. of pence.	prod. of farth.
£ s.	d.	8	3
8 14	8 ¾	2	2
	2		
17 9	5 ½	12)17(1	4)6(
		12	1½
		5	

prod. of shillings
14
2
20)29(1
20
9

(2)

£	s.	d.
6	13	3
		2

(3)

£	s.	d.
10	15	6
		3

(4)

£	s.	d.
62	5	4½
		5

(5)

£	s.	d.
35	12	7¾
		7

WEIGHTS AND MEASURES.

(6)

lb.	oz.	dwt.	gr.
17	5	12	6
			3

(7)

T.	cwt.	qr.	lb.	oz.	dr.
5	16	2	12	1	14
					4

(8)

L.	m.	fur
15	2	7
		6

(9)

Yd.	ft.	in.	b.c.
14	1	10	2
			7

(10)

Yd.	qr.	na
14	1	2
		10

(11)

A.	r.	p.
47	3	15
		9

(12)

Bush.	pe.	qt.
6	2	6
		5

(13)

W.	d.	h.	min.	sec.
3	6	19	30	20
				4

(14)

Deg.	′	″
30	15	12
		8

CASE 2.

When the given multiplier exceeds 12, and is the exact product of some two factors in the multiplication table.

RULE.

Multiply the given sum by one of said factors, and that product by the other; the last product will be the answer.

EXAMPLES.

		£	s.	d.		£	s.	d.
15.	14 yards, at	0	17	6		0	17	6
					2×7=14			7
		1	15	0		6	2	6
				7				2
		12	5	0	Proof	12	5	0

		£	s.	d.			£	s.	d.
16.	Multiply	0	9	6	by 18	*Ans.*	8	11	0
17.		0	7	7½	by 21		8	0	1½

		T.	cwt.	qr.			T.	cwt.	qr.
18.		40	11	3	by 35	*Ans.*	1420	11	1
19.		18	0	1	by 54	*Ans.*	972	13	2

		Yd.	ft.	in.			Yd.	ft.	in.
20.		4	2	11	by 66	*Ans.*	328	0	6
21.		3	1	8	by 72	*Ans.*	256	0	

CASE 3.

When the multiplier is not the exact product of any two factors in the multiplication table.

RULE.

1. Take two factors, whose product is the least short of the multiplier, and multiply by them as before.

2. Multiply the given sum by the number which supplies the deficiency.

3. Add its product to the sum produced by the two factors, and their amount will be the answer.

EXAMPLES.

22. Multiply s. d. 3 8 by 19

3×6+1=19

	11	0
		6
3	6	0
	3	8
3	9	8

23. Multiply oz. dwt. gr. 2 1 13 by 68

11×6+2=68

	22	16	23
			6
137	1	18	
4	3	2	
141	4	20	*Ans.*

		£	s.	d.			£	s.	d.
24.	Multiply	1	2	6	by 26	*Ans.*	29	5	0
		lb.	oz.	dwt.			lb.	oz.	dwt.
25.		1	10	11	by 43	*Ans.*	80	9	13
26.		2	1	8	by 37	*Ans.*	78	3	16
		EE.	qr.	na.			EE.	qr.	na.
27.		4	1	2	by 74	*Ans.*	318	1	0
28.		10	4	1	by 97	*Ans.*	1052	2	1

CASE 4.

When the multiplier is greater than the product of any two factors in the table.

RULE.

1. Multiply the price of 1 yard by 10, which will give the price of ten yards.

2. Multiply this product by 10, will give the price of one hundred yards.

3. Then if the quantity do not exceed hundreds, multiply the price of 100 yards by the number of hundreds in the question; the price of 10 by the number of tens; and the price of 1, by the number of units.

4. Add these several products together, and their sum will be the answer.

EXAMPLES.

		s.	d.	
29. Multiply		1	7½	price of 1 yard.
by 276			10	
		16	3	price of 10 yards.
			10	
		8	2	6 price of 100 yards.
			2	
		16	5	0 price of 200 yards.
10 yd. × 7 =		5	13	9 price of 70 yards.
1 yd. × 6 =			9	9 price of 6 yards.
	Ans. £	22	8	6 price of 276 yards.

	£	s.	d.				£	s.	d.
30. Multiply	0	1	2	by	195	*Ans.*	11	7	6
31.	0	17	3½	by	473		408	18	11½
32.	0	3	3	by	407		66	2	9
33.	1	3	6	by	165		193	17	6
34.	0	3	9½	by	284½		53	18	8¾
35.	0	3	5½	by	2375		410	13	6½

APPLICATION.

36. An apothecary had 3 apprentices; and he directed that each one should take 35lb 9℥ 4℥ 2℈ 15 gr. of medicine, and mix it. How much was there mixed in all?

Ans. 107lb 4℥ 6℥ 2℈ 5 gr.

37. A merchant purchased 27 pieces of broad-cloth; each piece contained 19 yd. 3 qr. 1 na. What was the quantity purchased? *Ans.* 534 yd. 3 qr. 3 na.

38. A man in performing a journey travels 32 miles 4 fur. 16 pol. each day, for 17 days in succession; what distance did he travel? *Ans.* 553 m. 2 fur. 32 pol.

39. A father divides his landed property among his 7 sons, giving each one a farm containing 150A. 3r. 12p. How many acres in the whole? *Ans.* 1055 A. 3 r. 4 p.

40. What quantity of cider is contained in 45 barrels; each barrel 31 gal. 2 qt.? *Ans.* 1417 gal. 2 qt.

41. A year contains 52 weeks, 1 day, and 6 hours. How many weeks has the scholar lived who can do this sum when he is 8 years old? *Ans.* 417 weeks, 3 days.

42. Sold 10 tons of hay at £6 17s. 4½d. a ton: what is the amount? *Ans.* £68 13s. 9d.

43. A Goldsmith bought 11 ingots of silver, each of which weighed 4 pounds, 1 ounce, 15 pennyweights, 22 grains; what is the weight of the whole? *Ans.* 45lb. 7oz. 15dwt. 2gr.

44. A grocer bought 5 hogsheads of sugar, weighing each 11 cwt. 2qr. 16lb.; how much did the whole weigh?

Ans. 58cwt. 0qr 24lb.

45. There were 352 bags of corn, each containing 2 bushels, 3 pecks; how many bushels are there in the whole?

Ans. 968 bushels.

COMPOUND DIVISION.

Compound Division teaches to divide any sum or quantity which consists of different denominations.

CASE 1.

When the divisor does not exceed 12.

RULE.

1. Begin at the left hand and divide the several denominations of the given sum one after another, and set their respective quotients underneath.

2. When a remainder occurs in dividing either of the denominations, multiply it by the next lower denomination, and add in the number of any, which divide by the given divisor, and if a remainder again occurs, proceed in the same manner.

3. If the number of either denomination be not large enough to contain the divisor, multiply it by the next lower denomination and add in the number; then divide and proceed as before.

PROOF.

Multiply the quotient by the divisor, and the product will be equal to the dividend.

EXAMPLES.

(1)

(20)(12)(4)

	£	s.	d.
6)743	8	4	½
	123	18	0 ¾
			6
Proof	£743	8	4 ½

£	
5	remainder.
20s.	make 1 £
100	
8	Added.
6)108	
18s.	

4d.
4 qrs. make 1 penny,

16

2 added

6)18

$\frac{3}{4}$ qr.

(2)

£.	s.	d.
2)47	14	8

(3)

£	s.	d.
3)66	19	$11\frac{1}{4}$

(4)

£	s.	d.
5)59	16	$7\frac{1}{2}$

(5)

£	s.	d.
6)34	13	2

(6)

£	s.	d.
9)346	1	$3\frac{1}{2}$

(7)

lb.	oz.	dwt.	gr.
2)25	9	13	10

(8)

T.	cwt.	qr.	lb.	oz.	dr.
3)43	17	3	20	11	8

(9)

L.	m.	fur.	p.
5)420	1	4	13

(10)

A.	r.	p.
8)82	3	18

(11)

Yd.	qr.	n.
10)94	2	3

(12)

T.	hhd.	gal.	qt.	pt.
9)26	3	41	1	1

(13)

W.	d.	h.	min.	sec.
12)23	6	20	31	20

CASE 2.

When the dividing number is the exact product of some two factors in the multiplication table.

RULE.

Divide by one of the said factors, and then divide that quotient by the other factors, as before directed.

(14)

	£	s.	d.	
Divide	173	14	7	by 16
	£	s.	d.	
	4)173	14	7	
	4)43	8	7¾	
Ans.	10	17	1¾	

(15)

	Yd.	ft.	in.	
Divide	72	2	8	by 24
	Yd.	ft.	in.	
	4)72	2	8	
	6)18	0	8	
Ans.	3	0	1+2	

		£	s.	d.			£	s.	d.
16.	Divide	29	15	0	by 21	*Ans.*	1	8	4
17.		27	16	0	by 32		0	17	4½

		T.	hhd.	gal.			T.	hhd.	gal.
18.		11	3	16	by 44	*Ans.*	0	1	4+
19.		269	1	12	by 56	*Ans.*	4	3	14+

		A.	r.	p.			A.	r.	p.
20.		150	3	15	by 121	*Ans.*	1	0	39+
21.		16	2	8	by 144	*Ans.*	0	0	18+

CASE 3.

When the dividing number is not the exact product of any two factors in the table.

RULE.

Divide the greatest denomination by the said number, as in Long Division; multiply the remainder, if any, by as many of the next denomination as make one of that, adding in the number of the next name; divide the product as before; and so proceed.

EXAMPLES.

22. Divide £ s. d. 36 16 3 by 19

£ s. d.		£ s. d.
19)36 16 3(1 18 9 Quotient.		1 18 9×1
19		3
Remainder £17		5 16 3
Multiply by 20s. make £1 and add in 16s.		6
19)356		34 17 6
19		1 18 9
166	Proof	36 16 3
152		

Rem. 14 shillings
Multiply by 12 pence in a shilling, and add in 3d.

19)171
171

	£	s.	d.		£	s.	d.
23. Divide	113	13	4 by 31	*Ans.*	3	13	4

	Bu.	pe.	qt.		Bu.	pe.	qt.
24.	38	3	1 by 47	*Ans.*	0	3	2+
25.	189	0	2 by 95	*Ans.*	1	3	7+

	Y	mo.	w.		Y.	mo.	w.
26.	47	2	2 by 147	*Ans.*	0	3	3+
27.	3236	9	3 by 654	*Ans.*	4	11	1+

APPLICATION.

28. Sold 8 yards of linen for £3 11s. 8d. what was the price a yard? *Ans.* 8s. 11½d.

29. What is the price of a bushel of wheat, when 42 bushels are sold for £17 13s. 6d. *Ans.* 8s. 5d.

30. A miller bought of 16 different men 450bu. 3pe. 2qt. of wheat, and of each an equal quantity; how much did each man sell? *Ans.* 28bu. 0p. 5qt.+

31. Admit there are on the Hudson river between New-York and Albany 12 towns, each one an equal distance from the other; how far are they apart, the distance being 160 miles, 2fur. 28 poles? *Ans.* 13m. 2fur. 35p.+

32. A Township has 73492 acres, and in it are 428 farms; how large is each one, supposing them all of an equal size?
Ans. 171A. 2r. 33p.+

33. A lunar year contains 13 months, how long is each, admitting the year to be 52 weeks, 1 day, 6 hours? *Ans.* 4w. 2h.+

PROMISCUOUS EXAMPLES IN COMPOUND ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION.

34. Bought two pieces of linen, one of which contained 30 yards, and the other 25; the price was 93¼cts. per yard; what was the cost of the two pieces? *Ans.* $51 42½cts.

35. Sold a piece of cloth containing 8 yards, at £2 14s. a yard; and another piece containing 12 yards at £1 13s. 4d. a yard; what is the amount of the whole? *Ans.* £41 12s.

36. A person has £500 18s. 9d. He owes to one man £25 10s.; to another £76 18s. 9d.; to another £175 10s. and to another £100. What sum will he have left after paying these debts? *Ans.* £123.

37. A grocer has 10 bags of sugar, weighing each 120lb.; and 3 bags, weighing each 145lb.: if he sell 630lb., what quantity will remain? *Ans.* 1005lb.

38. Bought 4 pieces of linen, containing 21 yards, 3 quarters each; and 3 pieces, containing 35 yards, 2 quarters each; from which was afterwards sold 141 yards; what number of yards was then remaining? *Ans.* 52yd. 2qr.

39. A farmer has three farms; the first contains 125 acres, 3 roods; the second 200 acres, 2 roods, 18 perches; the third 175 acres 10 perches. He intends to divide these farms equally between his two sons; what will be the share of each son?
Ans. 250A. 2R. 34P.

40. A person at his decease, left property to the amount of $3128 16cts. His will directed that $300 75cts. should be given to the poor, and the remainder equally divided among his 3 sons; what was the portion of each? *Ans.* $942 47cts.

QUESTIONS IN FEDERAL MONEY.

What are the denominations of Federal Money, and what is the value of each?

Why do we add, subtract, multiply, and divide, in Federal Money in the same manner as in whole numbers?

Is it customary in reading sums in Federal Money to mention eagles and dimes?

How do we place the several sums in Addition of Federal Money to add them?

After having placed the different denominations, what is the rule for adding them?

How are dollars, cents, and mills distinguished?

How is Addition of Federal Money proved?

How is Subtraction of Federal Money performed?

How is Multiplication of Federal Money performed?

How is Division of Federal Money performed?

When there are only dollars in the dividend, and cents and mills as well as dollars are required in the quotient, how do we proceed?

When there are mills and cents in the dividend, how do we point off the quotient to show which are the mills, which the cents, and which the dollars?

QUESTIONS IN WEIGHTS AND MEASURES.

What are the denominations of English Money?

What are the marks used in English Money?

Repeat the Pence Table.

What are the denominations of Troy Weight?

What articles are weighed by Troy Weight?

What are the denominations of Avoirdupoise Weight?

What articles are weighed by Avoirdupoise Weight?

What are the denominations of Apothecaries Weight?

What is the use of Apothecaries Weight?

What are the denominations of Cloth Measure?

What is the use of Cloth Measure?

What are the denominations of Long Measure?

What is the use of Long Measure?

How much is a hand, and what is its use?

How much is a fathom, and what is its use?

How many links are there in a chain, and what is its length?

What are the denominations of Land or Square Measure?

What is the use of Land or Square Measure?

What are the denominations of Solid or Cubic Measure?

What is Solid or Cubic Measure used for?

What are the denominations of Liquid Measure?

What is the use of Liquid Measure?

What are the denominations of Dry Measure?

What is Dry Measure used for?

What are the denominations of Time?

What are the names of the months, and how many days has each month respectively?

What is meant by leap year?

How do we know when it is leap year?

Repeat the verse which shows the number of days in each month?

What are the denominations of Circular Motion?
What use is made of Circular Motion?
How many shillings make a pound?
How many acres are there in a square mile?
How many days are there in a year?
How many quarters, and how many pounds make a cwt.?
How many furlongs make a mile?
How many yards, or how many feet make a rod?
How many gallons make a hogshead?
How many weeks are there in a year?
How many square inches are there in a square foot?
How many gallons make a barrel?
How many feet in length, breadth, and height make a cord?
How many quarters make a Flemish ell?
How many ounces make a pound Troy Weight?
How many geographical, and how many statute miles make a degree?
How many pecks make a bushel?
How many hours make a day?
How many rods or roods make an acre?
How many hogsheads make a ton?
How many grains make a scruple?
How many ounces make a pound Avoirdupois weight?
How many quarters make an Ell English?
How many miles make a league?
How many pence make a shilling?
How many months make a year?

QUESTIONS IN COMPOUND ADDITION.

What does Compound Addition teach?
How are the different denominations placed in Compound Addition to be added?
What is the rule for adding and carrying in Compound Addition?
How is compound Addition proved?

QUESTIONS IN COMPOUND SUBTRACTION.

What does Compound Subtraction teach?
How are the denominations in Compound Subtraction to be placed?
Where do we begin to subtract?
How do we proceed when the lower number is greater than the one above it?
How is Compound Subtraction proved?

QUESTIONS IN COMPOUND MULTIPLICATION.

What does Compound Multiplication teach?

Where must the multiplier be placed?

After placing the multiplier in its proper place, what is then done?

When the product is equal to, or exceeds the next higher denomination, how do we proceed?

What is the rule when the multiplier exceeds 12, but is the exact product of two factors in the table?

When no two numbers multiplied together will produce the given multiplier, what then is the rule?

What is the rule when the multiplier is greater than the product of any two factors in the table?

QUESTIONS IN COMPOUND DIVISION.

What does Compound Division teach?

What is the rule for dividing when the divisor does not exceed 12?

How is Compound Division proved?

When the dividing number is the exact product of two factors in the multiplication table, what is the rule?

How is the division performed when the dividing number is not the exact product of any two factors in the table?

REDUCTION.

Reduction is the changing of a given sum or quantity to a different denomination, retaining the same value.

1. When large denominations are to be brought into smaller ones, as pounds into shillings, feet into inches, cwt. into pounds, &c.

RULE.

Multiply the given sum, or when of divers denominations its greatest name, by as many of the next lower denomination as will make one of that, adding in said less denomination (if any) and so proceed from one denomination to another, until the whole is reduced to the denomination required.

Note.—Thus, if it be required to reduce pounds to farthings, first multiply by as many shillings as make a pound, adding in the odd shillings (if any) the product will be shillings: make by as many pence as make a shilling, adding in the odd pence, (if any) this product will be pence; then, by as many farthings as make a penny, adding in the odd farthings, (if any) and this product will be the farthings required: OR, if it be required to reduce a cwt. to ounces, first multiply by as many qrs. as then, a cwt.; then by as many pounds as make a qr.; then by as many ounces as make a pound, and this last product will be ounces; to add in the odd denominations, (if any) in their proper places; and so of any other question.

2. When small denominations are to be brought into larger ones, as pence into shillings, gallons into hogsheads, pounds into cwt. &c.

RULE.

Divide the given sum by as many of its own denomination as will make one of the next greater; and so on from one denomination to another, until it is brought to the denomination required,

If in dividing there should be a remainder, it will be of the same name as the dividend.

Note.—Thus, if it be required to bring pence to pounds, first divide the given denomination by as many pence as make a shilling, the quotient will be shillings, and the remainder, (if any) will be pence; then divide again this quotient by as many shillings as make a pound, and this quotient will be pounds, and the remainder, (if any) shillings:—or, if it should be required to bring pounds to cwt. first divide by as many pounds as make a qr.; then divide again by as many qrs. as make a cwt. this last quotient will be the cwt. required; observe the same rule as before, respecting remainders, when any occur.

PROOF.

Reduce the result of the operation back to the name given.

FEDERAL MONEY.

1. In 45dols. 3cts. 8m. how many mills? *Ans.* 45038 mills.

Dol.	cts.	m.
45	3	8.
100		
4503		
10		

Ans. 45038 mills.

2. In 387652 mills, how many dollars? *Ans.* $387 65c. 2m.

1(0)38765(2

1(00)387(65 : 2

$387 65cts. 2m. *Ans.*

Note—A sum of Federal money, which consists of dollars and cents, or dollars, cents and mills, is reduced to cents or mills, by simply removing the separating point or points: or, if mills are to be brought into cents, separate one figure at the right hand for mills, and the remainder will be cents; and if cents into dollars, separate two figures at the right hand for cents, and the remainder will be dollars.

3. In $53 how many cents? *Ans.* 5300cts.
4. In 43862 mills, how many dollars? *Ans.* $43 86cts. 2m.
5. In 49dols. 34cts. how many cents? *Ans.* 4934cts.
6. How many eagles in 1933 dimes? *Ans.* 19E. 3dol. 3dim.
7. In 10dols. 6cts. how many mills? *Ans.* 10060m.
8. In 190004 mills, how many dollars? *Ans.* 190dols. 4m.
9. In 16dols. 41cts. how many cents? *Ans.* 1641cts.

ENGLISH, OR STERLING MONEY.

10. In £24, how many pence? *Ans.* 5700 pence.

£
24

Multiply by 20 because 20s. make one pound.

480 shillings.

Multiply by 12 because 12d. make one shilling.

Ans. 5760 pence.

11. In 4s. how many pence? *Ans.* 48d.
12. In £8 how many shillings? *Ans.* 160s.
13. Reduce £43 into shillings. *Ans.* 860s.
14. Bring £342 into shillings. *Ans.* 6840s.
15. In £16 how many shillings and pence? *Ans.* 320s. 3840d.
16. Reduce £83 into shillings and pence. *Ans.* 1660s. 19920d.
17. In £24 how many shillings, pence, and farthings? *Ans.* 480s. 5760d. 23040qr.
18. In £1573 how many shillings, pence, and farthings? *Ans.* 31460s. 377520d. 1510080qr.
19. In 20160 farthings how many pounds? *Ans.* £21.

Divide by 4 because 4 farthings make 1d. 4)20160 farthings.

——— by 12 ——— 12d. make a shilling. 12)5040 pence.

——— by 20 ——— 20s. make a pound. 2(0)42(0 shillings.

Ans. 21 pounds.

20. In 860 shillings how many pounds? *Ans.* £43.
21. In 580 shillings how many pounds? *Ans.* £29.
22. In 3840 pence how many shillings, and how many pounds? *Ans.* 320s. £16.
23. Bring 12480 farthings into pence, shillings, and pounds. *Ans.* 3120d. 260s. £13.

24. In 88 pounds how many pence? *Ans.* 21120d.
25. In 421 pounds how many farthings? *Ans.* 404160qr.
26. Bring 89040 pence into pounds. *Ans.* £371.
27. In 49920 farthings how many pounds? *Ans.* £52.
28. In £91 11s. 3½d. how many farthings? *Ans.* 87902qr.

£	s.	d.
91	11	3½

Multiply by 20 shillings in £1 and add 11s.

1831s.

——— by 12 pence in 1s. and add 3d.

21975d.

——— by 4 farthings in 1d. and add 2qr. (or 2 farthings.)

Ans. 87902qr.

29. In £53 16s. how many shillings? *Ans.* 1076s.
30. Bring 4s. 8d. into pence. *Ans.* 56d.
31. In 8s. 7¼d. how many farthings? *Ans.* 413qr.
32. Reduce £37 14s. 6d. into pence. *Ans.* 9054d.
33. In £124 16s. 8¾d. how many farthings? *Ans.* 119843qr.
34. In £48 9d. how many pence? *Ans.* 11529d.
35. In 68853 farthings how many pounds? *Ans.* £71 14s. 5¼d.

qr.
4)68853

12)17213 + 1qr. (or ¼)

2(0)143(4 + 5d.

Ans. £71 14s. 5¼d.

36. In 329s. how many pounds? *Ans.* £16 9s.
37. In 136d. how many shillings? *Ans.* 11s. 4d.
38. Reduce 13172d. into pounds. *Ans.* £54 17s. 8d.
39. Bring 6529qr. into pounds. *Ans.* £6 16s. 0¼d.
40. In 16971qr. how many pounds? *Ans.* £17 13s. 6¾d.
41. Reduce 21675 half pence into pounds. *Ans.* £45 3s. 1½d.

Note.—That scholars may understand reduction well, it is sometimes necessary to exercise them with questions without answers, a few are therefore introduced.

42. In 15s. how many pence?
43. In £37 how many shillings and pence?
44. In 235qr. how many pence?
45. In 8s. 7d. how many pence?

46. In 145214qr. how many pounds?
47. In £1432 how many pence?
48. In £84 13s. 4d. how many pence?
49. In 54d. how many farthings?
50. Reduce 18s. 9½d. into farthings.
51. In 6s. 8d. how many pence?
52. In 3641s. how many pounds?
53. In 4283s. how many pence?
54. Reduce £8 3d. into pence.
55. Reduce 16s. 1½d. into half pence.
56. Reduce 4173qr. into pounds.
57. In 4¼d. how many farthings?
58. In £15 3s. how many pence?

TROY WEIGHT.

59. In 47lb. 10oz. how many ounces, pennyweights and grains?
Ans. 574oz. 11480dwt. 275520gr.
60. In 12960 grains of gold, how many ounces? *Ans.* 27oz.
61. In 3lb. 10oz. 7dwt. 5gr. how many grains? *Ans.* 22253gr.
62. How many pounds are there in 47128 grains of gold?
Ans. 8lb. 2oz. 3dwt. 16gr.
63. Bought 7 ingots of silver, each containing 23lb. 5oz. 7dwt. how many grains? *Ans.* 945336 grains.

AVOIRDUPOIS WEIGHT.

64. In 3 tons, how many cwt. qrs. and lbs.?
Ans. 60cwt. 240qr. 6720lb.
65. In 89cwt. 3qr. 14lb. 12oz. how many ounces?
Ans. 161068 ounces.
66. In 573440 drams, how many tons? *Ans.* 1 ton.
67. Bring 892245 ounces into tons.
Ans. 24 tons, 17cwt. 3qr. 17lb. 5oz.
68. In 12hhd. of sugar, each 11cwt. 25lb. how many pounds?
Ans. 15084lb.
69. In 27cwt. of raisins, how many parcels of 18lb. each?
Ans. 168 parcels.

APOTHECARIES WEIGHT.

70. In 9℔ 8℥ 13 ℈ 19gr.; how many grains?
Ans. 55799gr.
71. In 69721 grains, how many pounds?
Ans. 12℔ 1℥ 2℥ 0℈ 1gr.

CLOTH MEASURE.

72. In 95 yards, how many quarters and nails?
Ans. 380qr. 1520na.

73. In 17yd. 1qr. 2na. how many nails? *Ans.* 278 nails.

74. In 3783 nails, how many yards? *Ans.* 236yd. 1qr. 3na.

75. In 56 ells Flemish, how many quarters and nails?
Ans. 168qr. 672na.

76. How many ells English in 5932 nails?
Ans. 296ells 3qr.

77. In 10 bales of cloth, each 10 pieces, and each piece 12 yards, how many yards? *Ans.* 1200 yards.

LONG MEASURE.

78. In 57 miles, how many furlongs and poles?
Ans. 456fur. 18240 poles.

79. In 4352 inches, how many yards? *Ans.* 120yd. 2ft. 8in.

80. How many inches from New-York to Albany, it being 160 miles? *Ans.* 10137600 inches

81. In 682 yards, how many rods or poles?
$682 \times 2 \div 11 = 124$ rods. *Ans.*

82. Reduce 2280060 barley-corns to miles?
Ans. 11m. 7fur. 38p. 2yd. 2ft.

83. How many barley-corns will reach round the globe of the earth, which is 360 degrees, and each degree 69½ miles?
Ans. 4755801600.

LAND OR SQUARE MEASURE.

84. In 40 acres, how many roods and perches?
Ans. 160 roods, 6400 perches.

85. In 17a. 3r. 10p. how many perches? *Ans.* 2850p.

86 Reduce 4392 perches into acres. *Ans.* 27a. 1r. 32p.

87 If a piece of ground contains 24 acres, and an enclosure of 17 acres, 3 roods, be taken out of it, how many perches will there be in the remainder? *Ans.* 1000 perches.

SOLID MEASURE.

88. In 14 tons of hewn timber, how many solid inches?
Ans. 1209600 inches.

89. In 19 tons of round timber, how many inches?
Ans. 1313280 inches.

90. In 5667840 solid inches, how many tons of round timber?
Ans. 82 tons

91. In 4608 solid feet of wood, how many cords?
Ans. 36 cords.

92. In a pile of wood 96 feet long, 5 feet high, and four feet wide, how many cords? *Ans.* 15 cords.

93. What are the contents of a load of bark, 6 feet long, 4 feet high, and $2\frac{1}{2}$ feet wide?
Ans. 60 solid feet which is nearly $\frac{1}{4}$ a cord.

LIQUID MEASURE.

94. In 9 tuns of wine, how many hogsheads, gallons, and quarts?
Ans. 36hhd. 2268gal. 9072qt.

95. In 10080 pints, how many tuns? *Ans.* 5 tuns.

96. In 24 hogsheads, 18 gallons, 2 quarts, how many pints?
Ans. 12244pt.

97. In 8 barrels, each $31\frac{1}{2}$gal. how many pints?
Ans. 2016pt.

DRY MEASURE.

98. In 136 bushels, how many pecks, quarts and pints?
Ans. 544pk. 4352qt. 8704pt.

99. In 486qt. how many bushels? *Ans.* 15bu. 0pk. 6qt.

100. In 49 bushels, 3 pecks, 5 quarts, how many quarts?
Ans. 1597qt.

101. A man would ship 720 bushels of corn, in barrels which hold 3 bushels, 3pk. each, how many barrels must he get?
Ans. 192 barrels.

TIME.

102. In 121812 seconds, how many hours?
Ans. 33hr. 50 min. 12sec.

103. In 41 weeks, how many days, hours, minutes, and seconds?
Ans. 287d. 6888h. 413280m. 24796800sec.

104. How many seconds in a year, allowing it to be 365 days, 6 hours? *Ans.* 31557600sec.

105. How many days in 18545485 seconds?
Ans. 214d. 15h. 31m. 25sec.

106. How many days from the birth of Christ, to Christmas 1815, allowing the year to contain 365 days, 6 hours?
Ans. 662928d. 18hr.

107. From 2d. of third month (March,) to the 19th. of eleventh month, (November) inclusive, how many days?
Ans. 262 days.

CIRCULAR MOTION.

108. In 6 signs of the Zodiac, how many minutes ?
Ans. 10800min.

109. Bring 1020300 seconds into signs. *Ans.* 9 signs, 13° 25'

CHANGING OF CURRENCIES.

1. To change the currency of each State to Federal Money.

RULE.

Divide the given sum, reduced to shillings, to sixpences, or to pence, by the number of shillings, sixpences or pence in a dollar, as it passes in each state.

A TABLE.

ich pass current in the United States of North America, with their Sterling and Federal value.

NAMES OF COINS.	Standing Weights.		Sterling Money of Great Britain.			Connecticut, Rhode-Island, and Virginia.			Vermont, New-Hampshire, Massachusetts.			New-York and North-Carolina.			New-Jersey, Pennsylvania, Delaware and Maryland.			South Carolina and Georgia.			Fed'l value.		
																					Dollars.	Cents.	Mills.
(GOLD.)	dwt.	gr.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	D.	C.	M.
A Johannes,	18	0	3	12	0	4	16	0	6	8	0	6	0	0	4	0	0	16	00	0
A half Johannes,	9	0	1	16	6	2	8	0	3	4	0	3	0	0	2	0	0	8	00	0
A Doubloon,	16	21	3	6	0	4	8	0	5	16	0	5	12	6	3	10	0	14	93	0
A Moidore,	6	18	1	7	0	1	16	0	2	8	0	2	5	0	1	8	0	6	00	0
An English Guinea,	5	6	1	1	0	1	8	0	1	17	0	1	15	0	1	1	9	4	66	7
A French Guinea,	5	5	1	1	0	1	7	6	1	16	0	1	14	6	1	1	5	4	60	0
A Spanish Pistole,	4	6	0	16	6	1	2	0	1	9	0	1	8	0	0	18	0	3	77	3
A French Pistole.	4	4	0	16	0	1	2	0	1	8	0	1	7	6	0	17	6	3	66	7
(SILVER.)																							
An Eng. or French Crown,	18	0	0	5	0	0	6	8	0	8	9	0	8	3	0	5	0	1	10	0
The Dollar of Spain, Sweden or Denmark,	17	6	0	4	6	0	6	0	0	8	0	0	7	6	0	4	8	1	00	0
An English Shilling,	3	18	0	1	0	0	1	4	0	1	9	0	1	8	0	1	1	0	22	2
A Pistareen.	3	11	0	0	10¾	0	1	2	0	1	7	0	1	6	0	0	11	0	20	0

☞ All other Gold Coins of equal fineness, at 89 cents per dwt, and Silver at 111 cents per oz.

EXAMPLES.

110. Reduce £135 6s. New-York currency, to dollars. *Ans.* $338 25cts.

£	s.
135	6
20	
8)2706	
$338+2	
100	
8)200	
25 cents.	

111. Change £573 4s. 6d. Pennsylvania currency, to dollars. *Ans.* $1528 60cts.

£	s.	d.
573	4	6
20		
11464		

1dol. 7s. 6d. or 15 sixpences 2 add 1

dols. cts

15)22929(1528 60
15
79
75
42
30
129
120
9
100
15)900(60
90

112. Reduce £63 15s. New-England or Virginia currency to Federal money. *Ans.* $212 50cts.

113. Reduce £431 New-York currency to Federal money. *Ans.* $1077 50cts.

114. Reduce £28 11s. 6d. Virginia currency to Federal money. *Ans.* $95 25cts.

115. Reduce £53 18s. South Carolina or Georgia currency to Federal money. *Ans.* 231dolls.

116. Reduce £37 10s. Pennsylvania currency to Federal money. *Ans.* 100dolls.

117. Reduce £214 10s. 7½d. New-York currency to Federal money. *Ans.* $536 32cts. 8m.+

118. Bring £20 18s. 5½d. New-England currency into Federal money. *Ans.* $69 74cts. 6m.+

2. To change Federal money to the currency of each state.

RULE.

Multiply the given sum in cents, by the number of pence in a dollar, and cut off two figures to the right of the product; what is left will be the answer in pence; and if the figures thus separated, be multiplied by 4, and two figures again cut off as before, those at the left hand will be the farthings.

EXAMPLES.

119. Reduce $425 47cts. to New-England currency.

Ans. £127 12s. 9¾d.

cts.
42547
72 pence in 6s. or $1

85094
297829

12)30633(84

2(0)255(2 9

£127 12s. 9¾d. *Ans.*

120. Reduce $438 42cts. to New-York, &c. currency.

Ans. £175 7s. 4¼d.+

121. Reduce $1971 96cts. to New-England or Virginia currency.

Ans. £591 11s. 9d.+

122. Reduce $315 44cts. to Pennsylvania currency.

Ans. £118 5s. 9½d+

123. Reduce $525 40cts. to South Carolina, &c. currency

Ans. £122 11s. 10¼d.+

124. Reduce $85 43cts. to Sterling money.

Ans. £19 4s. 5d.+

125. Reduce $254 28cts. to New-York currency.

Ans. £101 14s. 2¾d.+

NOTE 3. When the given sum is dollars, multiply by the number of shillings in a dollar, thus:

Reduce $486 to New-York currency.

Dols.
486
8

2(0)388(8

£194 8s. *Ans.*

126. Reduce 721 dollars to New-England or Virginia currency. *Ans.* £216 6s.

127. Reduce 674 dollars to New-York currency. *Ans.* £269 12s.

QUESTIONS IN REDUCTION.

128. How many yards are there in 352 nails?

129. In 6 tons how many pounds?

130. In 3 leagues, 2 miles, 7 furlongs, how many furlongs?

131. In ½lb. how many drams, Avoirdupois Weight?

132. In 11 acres how many perches?

133. Reduce £65 17s. 4d. Connecticut currency, to Federal money.

134. In 72 hogsheads, how many quarts?

135. In 8lb. 10oz. 5dwt. how many pennyweights?

136. In 7cwt. 14lb. how many pounds?

137. In 362 yards, how many nails?

138. In 4732 hours, how many weeks?

139. Change $437 10cts. to New-York currency.

140. Reduce 15yd. 2ft. to inches.

141. In a Lunar month, or 27d. 7h. 43m. 5sec. how many seconds?

142. Bring 222qr. into tons.

143. In 1oz. how many grains?

144. In 37 miles, 21 poles, and 6 inches, how many barley corns?

145. In 1597 quarts, how many bushels?

146. In 4½ days, how many minutes?

147. Reduce 42 ells French, into nails.

PROMISCUOUS QUESTIONS.

148. In £916 10s. 9¾d. how many farthings?
Ans. 879879qr.

149. In 11316157 drams, how many tons?
Ans. 19tons, 14cwt. 2qr. 19lb. 11oz. 13dr

150. Suppose a merchant had orders to ship 892cwt. 3qr. 12lb. of beef, in barrels, each to contain 200lb. how many barrels will he want? *Ans.* 500 barrels.

151. How many dollars and cents are equal to £124 8s. New-York currency? *Ans.* $311.

152. In 346 guineas at 21s. each, how many shillings and pence? *Ans.* 7266s. 87192d.

153. How many spoons weighing each 5oz. 10dwt. will 10lb 1oz. of silver make? *Ans.* 22.

154. How many pints, quarts, and two quarts, each an equal number, may be filled from a pipe of wine? *Ans.* 144.

155. In £50 how many shillings, nine-pences, six-pences, four-pences, and pence, and of each an equal number? *Ans.* 375.

156. In 4 bales of cloth, each 12 pieces, and each piece 24 ells English, how many yards and ells Flemish?

Ans. 1440 yards, 1920 ells Flemish.

157. How many marks, each 13s. 4d. are in £496 13s. 4d.? *Ans.* 745.

158. If a ship's cargo be 250 pipes, 130 hogsheads, and 150 half ditto; how many gallons in all? And allowing each pint to be a pound, what will be the burden of the ship?

Ans. 44415gal. ship's burden 158 tons, 12cwt. 2qr.

159. If 4yd. 1qr. 3na. of cloth will make a suit of clothes for one man, what quantity will be required to make one suit a piece for 425 men? *Ans.* 1885yd. 3qr. 3na.

160. One field contains 7 acres, another 10 acres, and a third 12 acres 1 rood; how many shares of 76 perches each are contained in the whole? *Ans.* 61 shares and 44 perches over.

161. How many times does a wheel, which is 18 feet 6 inches round, turn between Albany and Utica, which is 93 miles?

Ans. 26542 times, and 156 inches over.

162. How long will it take to count a million at the rate of 50 a minute? *Ans.* 13d. 21h. 20m.

VULGAR FRACTIONS.

A Vulgar Fraction is a part, or parts of a unit or integer, expressed by two numbers, placed one above the other with a line drawn between them; as $\frac{1}{4}$ one fourth, $\frac{2}{3}$ two thirds, &c.

The number above the line is called the numerator, and that below the line, the denominator.

A fraction is said to be in its least or lowest terms, when it is expressed by the least numbers possible; as $\frac{4}{8}$, when reduced to its lowest terms, will be $\frac{1}{2}$; and $\frac{6}{12}$ is equal to $\frac{3}{4}$, &c.

VULGAR FRACTIONS.

CASE I.

To reduce Fractions to their lowest terms.

RULE.

Divide the greater term by the less, and that divisor by the remainder, till nothing be left; the last divisor will be the common measure; by which divide both terms, for the fraction required or the lowest terms.

EXAMPLES,

1. Reduce $\frac{91}{117}$ to its lowest terms. *Ans.* $\frac{7}{9}$.

91)117(1
91

26)91(3
78

Common measure 13)26(2
26

13)$\frac{91}{117}$($\frac{7}{9}$ *Ans.*

2. Reduce $\frac{144}{240}$ to its lowest terms. *Ans.* $\frac{3}{5}$.
3. Reduce $\frac{30}{125}$ to its lowest terms. *Ans.* $\frac{6}{25}$.
4. Reduce $\frac{48}{56}$ to its lowest terms. *Ans.* $\frac{6}{7}$.
5. Reduce $\frac{162}{324}$ to its lowest terms. *Ans.* $\frac{1}{2}$.
6. Reduce $\frac{216}{368}$ to its lowest terms. *Ans.* $\frac{2}{4}$.
7. Reduce $\frac{2002}{6864}$ to its lowest terms. *Ans.* $\frac{52}{171}$.
8. Reduce $\frac{45}{315}$ to its lowest terms. *Ans.* $\frac{1}{7}$.
9. Reduce $\frac{225}{900}$ to its lowest terms. *Ans.* $\frac{22}{64}$.
10. Reduce $\frac{144}{1152}$ to its lowest terms. *Ans.* $\frac{2}{16}$.

CASE 2.

To reduce the value or quantity of a fraction to the known parts of an integer

RULE.

Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

11. What is the value of $\frac{2}{3}$ of a pound sterling?

Numer. 2

20 shillings in a pound.

Denom. 3)40(13s. 4d. *Ans.*

3

10

9

1

12 pence in a shilling.

3)12(4d.

12

12. What is the value of $\frac{3}{4}$ of a pound sterling? *Ans.* 15s.

13. Reduce $\frac{1}{2}$ of a shilling to its proper quantity.
Ans. 4d. $3\frac{1}{2}$qr.

14. Reduce $\frac{5}{7}$ of a pound Avoirdupois to its proper quantity.
Ans. 9oz. $2\frac{2}{7}$dr.

15. Reduce $\frac{7}{8}$ of a hundred weight to its proper quantity.
Ans. 3qr. 3lb. 1oz. $12\frac{4}{8}$dr.

16. Reduce $\frac{3}{5}$ of a pound Troy to its proper quantity.
Ans. 7oz. 4dwt.

17. Reduce $\frac{1}{2}$ of a mile to its proper quantity.
Ans. 6fur. 16po.

18. Reduce $\frac{1}{4}$ of an acre to its proper quantity.
Ans. 2R. 20po.

19. Reduce $\frac{1}{4}$ of a hogshead of wine to its proper quantity.
Ans. 54 gallons.

20. Reduce $\frac{3}{4}$ of a month to its proper quantity.
Ans. 2wk. 2d. 19h. 12m.

THE SINGLE RULE OF THREE.

The Single Rule of Three, teaches by three numbers given, to find a fourth, in such proportion to the third, as the second is the first; it is called the Rule of Three from its having three

numbers given. Of the three numbers given, two are called the Terms of Supposition, and the other the Term of Demand.

RULE FOR STATING.

1. Place that term or number in the third place which is of the same name or kind with the answer: *that is, if the answer is money, the third term must be money; or if the answer be weight or measure, then the third must be weight or measure.*

2. Then consider, from the nature of the question, whether the answer is to be more or less than the third term. If more, set the greater of the two remaining terms in the second place, and the lesser in the first place; but if the answer is to be less than the third term, then set the less one in the second place, and the greater in the first place.

RULE FOR WORKING.

3. If the first and second terms are of different denominations, reduce them both to the lowest denomination in either.

4. If the third consist of several denominations, reduce it to the lowest one mentioned.

5. Then multiply the second and third terms together, and divide by the first; and the quotient will be the fourth term or answer, which will be in the same denomination as the third, or as that to which the third was reduced.

Note.—When a remainder occurs multiply it by the next lower denomination, and divide by the first term, and so on.

PROOF.

Invert the question, making the answer the third term.

EXAMPLES.

1. If 2 yards of muslin cost 45cts. what will 8yd. cost? *Ans.* $1 80cts.

	Yd.		Yd.		cts.
As	2	:	8	: :	45
					8
					2)360
					$1 80cts. *Ans.*

2. What is the worth of 2cwt. 1qr. 12lb. sugar when 1lb. costs 10½cts? *Ans.* $27 72cts.

lb.		Cwt.	qr.	lb.		cts.
As 1	:	2	1	12	: :	10½
		4				
		9				
		28				
		264				
		10½				
		132				
		2640				
		$27 72cts.				

Note.—The foregoing rule renders the distinction between Direct and Inverse proportion useless—and is likely soon to be introduced into general use—the following is, however, subjoined.

THE SINGLE RULE OF THREE DIRECT.

The Rule of Three Direct is that wherein the third term is greater than the first, and requires the fourth term or answer to be greater than the second, or the third less than the first, and requires the fourth to be less than the second.

RULE FOR STATING.

1. Place that number in the third place which we want to find the value of.

2. Place that one which is of the same name with the third in the first place; or, in other words, *if the third term is money, the first must be money; if the third term is weight or measure, the first must be weight or measure.*

3. Place the remaining one in the second place, which must be of the same name with the answer; *that is, if the answer is money, the middle must be money,* &c.

RULE FOR WORKING.

4. If the first and third terms be of different denominations, reduce them both to the lowest denomination in either.

5 If the second consist of several denominations reduce it to the lowest one mentioned.

6. Then multiply the second and third term together and divide the product by the first, and the quotient will be the fourth term or answer; which will be in the same denomination as the second, or as that to which the second was reduced.

EXAMPLES.

1. If 2 yards of muslin cost 45cts. what will 8 yards cost?
Ans. $1 80cts.

Yd.		cts.		Yd.
If 2	:	45	: :	8
		8		
		2)360		
		$1 80cts. *Ans.*		

2. What is the worth of 2cwt. 1qr. 12lb. of sugar when 1lb. cost 10½cts. *Ans.* $27 72cts.

lb.		cts.		Cwt.	qr.	lb.
If 1	:	10½	: :	2	1	12
				4		
				9		
				28		
				264		
				10½		
				132		
				2640		
				$27 72cts. *Ans.*		

3. If 4 yards of cloth cost $7 what cost 20 yards? *Ans.* $35.
4. If 1lb. of cotton cost 15cts. what cost 12lb.? *Ans.* $1 80c.
5. If 28lb. butter cost $5 92cts. what cost 7lb.? *Ans.* $1 48c.
6. If a cheese weighs 24lb. what is the worth of it at 10cts. a lb.? *Ans.* $2 40cts.
7. If 3 yards of cloth cost $5 what cost 81 yards? *Ans.* $135
8. If 5lb of sugar cost 9s. what will 30lb. cost? *Ans.* £2 14s
9. If 20 yards cost $120 how many yards may I have for $30?
Ans. 5yd.
10. If 50cts. buy 7lb. of sugar, how much will $6 38cts. buy?
Ans. 89lb. 4

11. If 1 yard of cloth cost $3 12½cts. what will be the worth of 20 yards? *Ans.* $62 50cts.

12. If 12 yards of cloth cost $9 75cts. what cost 192 yards? *Ans.* $156.

13. If 16lb. of sugar cost £1 8s. what is the value of a cwt? *Ans.* £9 16s.

14. What will 9 yards of cambric cost, at the rate of $40 96cts. for 72 yards? *Ans.* $5 12cts.

15. Bought a cwt. of sugar for $8 75cts. What is the value of 14lb. of the said sugar? *Ans.* $1 9cts. 3m.+

16. If 1cwt. of sugar cost $13 70cts. 6m. what will 8cwt. cost? *Ans.* $109 64cts. 8m.

17. At 15cts. a lb. what is loaf sugar a cwt.? *Ans.* $16 80cts.

18. If 1lb. of cheese cost 10½d. what is the worth of 1cwt.? *Ans.* £4 18s.

19. If 9cwt. 3qr. of sugar cost 50 dollars, what will 2cwt. 1qr. 11lb. cost? *Ans.* $12 4cts.+

20. How many bushels of rye may be bought for $250 at 81cts. a bushel? *Ans.* 308bu. 2p. 4qt.+

21. If 1 bushel of corn be sold for 59cts. what will 24 bushels come to? *Ans.* $14 16cts.

22. Bought a firkin of butter containing 56lb. for $9 25cts. what is that a lb. *Ans.* 16cts. 5m.+

23. A merchant bought a lot of pork, containing 16 hogs weighing together 3752lb. at $5 50cts. a hundred; what come they to? *Ans.* $206 36cts.

24. Sold 156lb. of cheese at 7½cts. a pound; what is the price of the whole? *Ans.* $11 70cts.

25. If 36oz. 10dwt. of silver be worth $24 33cts.; how much is that an ounce? *Ans.* 66cts. 6m.+

26. If 1 hogshead of molasses, containing 103 gallons, cost £17 4s. 8d.; what is it a gallon? *Ans.* 3s. 4d.+

27. If the price of 1 acre of land be $18 25cts. what will 50 acres, 2 roods, 20 perches come to? *Ans.* $923 90cts.+

28. Bought 12 pieces of cloth, each 12 yards, at $1 40cts a yard; what come they to? *Ans.* $201 60cts.

29. If a man's yearly income be $300, what will it be a day? *Ans.* 82cts.+

30. If a man spend 7d. a day, how much is that in a year? *Ans.* £10 12s. 1d.

31. If 4½ tons of hay will keep 3 cattle over the winter, how many tons will it take to keep 25 cattle the same time? *Ans.* 37½ tons.

32. A man bought sheep at $1 11cts. a head, to the amount of $51 6cts.; how many sheep did he buy? *Ans.* 46 sheep.

33. If 3½lb. of cheese cost 24cts. what cost 1cwt. ?
Ans. $7 68cts.

34. How much is tobacco an ounce, when 17cwt. 3qr. 17lb. sells for $320 80cts. *Ans.* 1ct.

35. When a bankrupt compounds with his creditors at 12s. 6d. on the £; how much is the merchant's part to whom he owes £1000. *Ans.* £625.

36. A merchant failing in trade, owes in all $29475, and delivers up his whole property, worth $21894 3cts.; how much does he pay on a dollar ? *Ans.* 74cts. 2m.+

37. What will be the value of 1475 bushels of Indian corn, at 87½cts. a bushel ? *Ans.* $1290 62½cts.

38. What does the carriage of 10cwt. 2qr. come to, at 1½cts. a pound ? *Ans.* $17 64cts.

39. If a pint of wine cost 10cts. what cost 3hhd. ?
Ans. $151 20cts.

40. If a pipe of Canary cost $115; how much is that a pint ?
Ans 11cts. 4m.+

41. If a person's income be $890 15cts. a year, how much may he spend each day, to save at the year's end $120 ?
Ans. $2 11cts.

42. If a man's annual income be 1333 dollars, and he expends daily $2 14cts.; how much will he save at the year's end ?
Ans. $551 90cts.

43. Bought 3 pipes of wine, containing 120½, 124, and 126¾ gallons, at 5s. 6d. a gallon; what come they to ?
Ans. £102 1s. 10½d.

44. What must be paid for 53 ells 1qr. (English,) of Holland at the rate of 97½cts. a yard ? *Ans.* $64 83cts. 7m.+

45. If a yard of broadcloth costs $2 25cts. what cost 5 pieces, each 25 yards ? *Ans.* $281 25cts.

46. What will be the value of a farm containing 225 acres at 43 75cts. an acre ? *Ans.* $9843 75cts.

47. What will the tax upon $1786 67cts. be, at the rate of 12 cents on a dollar ? *Ans.* $214 40cts.

48. What is the value of a silver tankard weighing 1lb. 7oz. 4dwt. at 79cts. an oz. *Ans.* $15 56cts.+

49. A draper bought 8 packages of cloth, each containing 4 pieces, each parcel 10 pieces, and each piece 26 yards, and gave at the rate of £4 16s. for 6 yards; I desire to know what the packages stood him in ? *Ans.* £665.

50. If a staff 4 feet long, cast a shade (on level ground) 7 feet long, what is the height of a steeple, whose shade, at the same time of day, is 203 feet ? *Ans.* 113+fe

To measure or divide it by the rule of 21, &c.

51. The earth, being 360 degrees in circumference, turns round on its axis in 24 hours; how far are the inhabitants at the equator carried in one minute, a degree there being 69½ miles?

Ans. 17m. 3fur.

INVERSE PROPORTION.

Inverse Proportion is that wherein the third term is greater than the first, and requires the fourth term or answer to be less than the second; or the third term less than the first, and requires the fourth to be greater than the second.

RULE.

After stating the sum as in Direct Proportion; then multiply the first and second terms together, and divide the product by the third term; the quotient will be the fourth term, or answer, as in Direct Proportion.

PROOF.

As in Direct Proportion.

EXAMPLES.

52. If 48 men men can build a wall in 24 days; how many men can do the same in 192 days.

	Days.	men.	days.
If	24	48	192
		24	

192)1152(6 men. *Ans.*
1152

Questions in Inverse Proportion may be more readily solved by the first rule in the Single Rule of Three.

EXAMPLES.

53. If 160 poles long and 1 pole wide, make an acre, how yards in length, that is 8 poles wide, must be taken to contain an acre? *Ans.* 20 poles.

54. How many labourers must be employed to finish a piece of work in 15 days, which 5 can do in 24 days? *Ans.* 8 men.

55. If a man perform a journey in 6 days, when the days are 12 hours long; in what time will he do it, when the day is 9 hours long? *Ans.* 8 days.

56. If I lend my friend $100 for 180 days, how long ought he to lend me $450 to return my kindness? *Ans.* 40 days.

$51 6ct

[illegible] yards of [illegible] long and 2 yards wide? *Ans.* 40 sheep.

58. If a board be 9 inches broad, what length will it require to measure 12 square feet? *Ans.* 16 feet.

59. What quantity of shalloon, that is 3 quarters of a yard wide, will line 7½ yards of cloth, that is 1½ yard wide?
Ans. 15 yards.

60. If when wheat is 83 cents a bushel, the cent loaf weighs 9oz. what ought it to weigh, when wheat is at $1 24cts. 5m. a bushel? *Ans.* 6oz.

61. There is a cistern having a pipe which will empty it in 15 hours; how many pipes of the same capacity will empty it in 3 quarters of an hour? *Ans.* 20 pipes.

62. How many yards of carpeting, that is 3 quarters of a yard wide, are sufficient to cover a floor that is 18 feet wide and 60 feet long? *Ans.* 160 yards.

63. What is the weight of a pea to a steelyard, which, being suspended 39 inches from the centre of motion, will equipoise 208lb. suspended at the draught end 3 quarters of an inch?
Ans. 4lb.

PROMISCUOUS EXAMPLES IN DIRECT AND INVERSE PROPORTION.

64. If 17 tons, 1 cwt. of iron cost 880 dollars, what is that for 2 cwt.? *Ans.* 5 dollars.

65. If 49362 case knives cost 4s. 4d. per doz. New-York currency, what is the value in Federal money.
Ans. $2229 50cts.

66. If an ingot of gold weighing 9lb. 9oz. 12dwt. is worth $1027 20cts. what is that a grain? *Ans.* 1ct. 3m.+

67. A borrowed of B £250 for 7 months; and in return lent him 300 dollars: how long ought B to keep it, that the interest of it may be equal to that of the first sum?
Ans. 5mo. 25 days.

68. The rents of a parish amount to £3500, and a rate is granted of £1251 5s. how much is that on a pound? *Ans.* 9d.

69. Bought 97½ yards of [illegible] yard, what does it amount to?

70. How much in length, that is 4½ inches broad, will make a piece 144 inches square? *Ans.* 32 inches.

71. If 1 cwt. of sugar cost 13dols. 50cts. what must be paid for 18cwt. 3qrs. 14lb? *Ans.* 241 31cts.+

72. If 12 pears are worth 21 apples, and 3 apples cost a cent, how many pears can be had for the number of fourscore and four pears? *Ans.* 48 pears, etc.

[illegible] of a State grant a tax of 8 mills on a dollar, how much will fall to the share of [illegible], penc[illegible]
[illegible] measure or divide it without a [illegible] of 21, &c.

dollar, how much must a man pay who is 319dols. 75cts. on the list? *Ans.* $2 55cts. 8m.

74. If 40 poles in length and 4 in breadth, make an acre, what must be the length to make an acre, when the breadth is 15 poles? *Ans.* 10 poles, 3yd. 2ft.

75. A drover having bought 64 fat oxen at 50dols. a head, expense of driving to market is 20dols., for butchering 33dols. 33 cents, of salt 26dols. 67cts. of barrels and storage 50dols. and he would gain 654dols. on the whole; what will be the price of 27 of said oxen in barrels? *Ans.* $1680 75cts.

76. A man bought a piece of cloth for $41 25cts. at $1 87½cts. a yard; how many yards did it contain? *Ans.* 22yd.

77. A owes B £596 6s. 8d. but failing in trade, he is able to pay but 15s. 6d. on the pound, how much is B to receive, and what is his loss?

Ans. he is to receive £462 3s. 2d. his loss is £134 3s. 6d.

78. I saw the flash of a gun, and heard the report one minute and 3 seconds afterwards; how far was I from the gun?

Ans. 13 miles, 5fur. 170yd.

Note—Sound, if not interrupted, moves 1150 feet in one second.

EXAMPLES IN THE SINGLE RULE OF THREE WITHOUT ANSWERS.

79. What cost 327 yards of canvass, at 19cts. a yard?

80. If 4 dollars will purchase 9 yards of cloth, what quantity may be bought for $140 75cts?

81. Bought 24 bushels of salt for $11 16cts. how much was it a bushel?

82. A labourer had $7 50cts. for 12 days, what was that a day?

81. If a field will feed 6 cows 91 days, how long will it feed 21 cows?

84. If a hogshead of wine cost $42, what was it a gallon?

85. What is the value of a cwt. of sugar at 9½cts. a pound?

86. At 28[illegible] 50 days, how much is it a day? cost 128lb. of tea?

89. If I buy 12 pieces of cloth, and each piece contain 35yd. at $2 18cts. a yard, what is the value of the whole?

90. A merchant bought of a farmer 12cwt. 2qr. 14lb. of cheese. and was to give him $8 75cts. a cwt., what must the farmer receive for his cheese?

91. A grocer bought 2cwt. 1qr. 14lb. of cloves, w[illegible] lon 34 [illegible] and he would gain £6 by the bargain. [illegible] sell them a pound?

[illegible] 1150 [illegible] rets. [illegible] [illegible] [illegible]

$173 15cts., but some damage having happened to it, I am willing to lose $15 87½cts. by the whole. At what rate must I sell it per yard?

93. A man bought a piece of cloth for $16 50cts. at 75cts. a yard. How many yards did it contain?

94. If 16 weeks' pay come to $47 9cts. what *is that a day*?

95. A certain tower projected upon level ground a shadow 63 yards 1 foot, when a staff 4 feet long placed perpendicularly cast a shadow 6 feet 4in. From this the height of the tower is required.

96. If 6352 stones of 3 feet long, will make a certain wall; how many stones of 2 feet long will make a wall of like quantity?

97. What quantity of corn can I buy for 90 crowns New-York currency, at the rate of 56cts. a bushel?

98. What is the value of 21yd. 1qr. of cloth, when 5yd. cost $9 16cts.?

99. There is a cistern having a pipe, which will empty it in 6 hours; how many pipes of the same capacity will empty it in 20 minutes?

100. How many yards of stuff, 3qr. wide, will line a cloak that is 5½yd. in length and 2yd. wide?

101. If 50 gallons of water, in one hour, fall into a cistern containing 230 gallons, and by a pipe in the cistern 35 gallons run out in an hour; in what time will it be filled?

102. A butcher went with $1040 to buy cattle; he bought oxen at $55 each, cows at $13, steers at $8 75cts., and calves at $3 25cts., and of each a like number; how many of each could he purchase with that sum?

103. A farm, containing 125A. 3r. 27p. was sold for $32 50 cents an acre; how much did it amount to?

104. Bought a cask of wine, at 57cts. a gallon for $125 dollars, how much did it contain?

105. Bought 92 pipes of wine, for $1273, paid freight for the same $94 13cts., loading and unloading $15, custom $25 75cts., cellar charges $18; at what price must I sell the said wine a pipe to gain $360?

106. Suppose a person travels 285 miles in 6 days 4 hours; at what rate is that an hour, allowing 12 hours to the day?

107. If the carriage of 5cwt. 14lb. for 96 miles be $5; how far may I have 3cwt. 1qr. carried for the same money?

108. How far will one be able to travel in 9 days 8 hours, at the rate of 12 miles every 4 hours, allowing 8 hours to a day?

Aliquot part or parts.

Measure or divide it without a remainder.

of 21, &c.

110. If my income is 109 guineas New-England currency a year, I desire to know what I may spend a day, in dollars and cents, so that I may lay up £45 at the year's end?

111. A ship's company of 21 men is on an allowance of 5 gills of water a day, when meeting a vessel they are supplied with 3 hogsheads of water; what addition will this make to their daily allowance, admitting their voyage to last 12 days longer?

112. I saw a flash of lightning and heard the thunder clap 26 seconds afterwards; how far is the cloud from me?

113. My income is 560 English guineas a year; I pay for the rent of my house £107 10s. New-York currency per annum, for my board 7½ dollars a week; how much is left for my other expenses a day? *Ans.* $4 58cts. 3m.+

114. A gentleman bought 13 pipes of wine at 12s. 6d. New-Jersey currency a gallon; how many dollars will pay the purchase? *Ans.* $3780.

115. What is the value in dollars, of 27cwt. 3qr. 15lb. of sugar, if 18lb. cost 19s. 6d. New-Hampshire currency?

Ans. $563 87½cts.

116. How many dollars will pay for 8 pipes of wine at the rate of £87 13s. 6d. New-York currency a hogshead? *Ans.* $2307.

117. Bought a quantity of plate weighing 15lb. 11oz. 13dwt. 17gr. how many dollars will pay for it at the rate of 12s. 7d. New-York currency an ounce? *Ans.* $301½+

118. If in four months I spend as much as I gain in three, how much do I lay by at the year's end, if I gain every 6 months $428 50cts.? *Ans.* $214 25cts.

119. If 19 yards of yard-wide stuff exactly line 14 yards of silk of another breadth, how many yards of the latter will line 184 pieces of the former, each piece containing 23½ yards?

Ans. 3064yd

120. How many yards of lace can I buy for $2146 at 5s. 6½d. sterling a yard? *Ans.* 1681yd. 2qr. 3n.+

PRACTICE.

Practice is a short method of ascertaining the value of any quantity of goods, by the given price of an integer.

PROOF.

Ans. 40 sheep.

TABLES OF ALIQUOT PARTS.*

Of a pound.			Of a shilling.		Of a Cwt.		Of a ½ Cwt.	
s.	d.	£	d.	s	qr.	lb.	lb.	
10	0	is ½	6	is ½	2	or 56 is ½	28	is ½
6	8	: ⅓	4	: ⅓	1	or 28 : ¼	14	: ¼
5	0	: ¼	3	: ¼		16 : 1/7	8	: 1/7
4	0	: ⅕	2	: ⅙		14 : ⅛	7	: ⅛
3	4	: 1/6	1½	: 1/8		8 : 1/14	4	: 1/14
2	6	: ⅛	1	: 1/12		7 : 1/16	Of a ¼ Cwt.	
2	0	: 1/10	Of a penny.				lb.	
1	8	: 1/12	qr.	d.			14	is ½
			1	: ¼			7	: ¼
			2	: ½			4	: 1/7

CASE 1.

When the price of an integer, (or the price of one yard, one gallon, &c.) is less than a penny.

RULE.

If the price be a farthing or a half-penny, divide the given number by as many thereof as make a penny, for the answer in pence.

If the price be three farthings, find the value of the given number at a half-penny, and afterwards at a farthing; then add the two results together, and their amount will be the answer in pence.

Note.—When remainders occur, proceed with them as under case 3, in Compound Division.

EXAMPLES.

1. What is the value of 4528 quills, at ¼ each?
2. What is the value of 4528 eggs, at ¾ each?

(1)

¼	¼	4528

12)1132 *Ans.* in pence.

2(0)9(4 4

Ans. £4 14 4

(2)

½	½	4528
¼	½	2264 value at ½
		1132 value at ¼

12)3396

2(8)28(3

Ans. £14 8s.

* Aliquot part or parts of a number or quantity is such part or parts as will measure or divide it without a remainder; thus, 3 is an aliquot part of 6, 7 of 21, &c.

					£	s.	d.
3.	5704	at	$\frac{1}{2}$	*Ans.*	5	18	10
4.	7612	at	$\frac{1}{4}$		7	18	7
5.	6813	at	$\frac{1}{2}$		14	3	$10\frac{1}{2}$
6.	7672	at	$\frac{1}{2}$		15	19	8
7.	9424	at	$\frac{3}{4}$		29	9	0
8.	1487	at	$\frac{3}{4}$		4	12	$11\frac{1}{4}$

CASE 2.

When the given price is a penny, or more than a penny, but less than a shilling.

RULE.

1. If the price be not the aliquot part of a shilling, separate it into parts, one of which shall be the aliquot part of a shilling, and the other either aliquot parts of this part, or of a shilling.
2. Divide the given quantity, by the aliquot parts of a shilling.
3. Divide the other aliquot parts, into the quotient of those prices, which they were the aliquot parts of.
4. Add the several sums together, for the answer in shillings.

EXAMPLES.

9. What is the value of 3711lb. of cheese at $7\frac{3}{4}$d.

		3711	at $7\frac{3}{4}$
6	$\frac{1}{2}$		
1	$\frac{1}{6}$	1855	6
$\frac{1}{2}$	$\frac{1}{12}$	309	3
$\frac{1}{4}$	$\frac{1}{24}$	154	$7\frac{1}{2}$
	$\frac{1}{48}$	77	$3\frac{3}{4}$

2(0)239(6 $8\frac{1}{4}$

£119 16 $8\frac{1}{4}$ *Ans.*

or thus,

		3711	at $7\frac{3}{4}$
4	$\frac{1}{3}$		
3	$\frac{1}{6}$	1237	0
$\frac{3}{4}$	$\frac{1}{4}$	927	9
		231	$11\frac{1}{4}$

2(0)239(6 $8\frac{1}{4}$

£119 16 $8\frac{1}{4}$ *Ans.*

			d.		£.	s.	d.
10.	1861	at	2	*Ans.*	15	10	2
11.	2147	at	$3\frac{1}{2}$		31	6	$2\frac{1}{2}$
12.	7000	at	$3\frac{3}{4}$		109	7	6
13.	3257	at	4		54	5	8
14.	2409	at	$4\frac{1}{6}$		43	9	10
	3210	at	5		66	17	6
	7521	at	$5\frac{3}{4}$		180	3	$9\frac{3}{4}$
	6610	at	$6\frac{1}{4}$		198	3	$6\frac{1}{4}$

			d.		£	s.	d.
18.	3271	at	7	*Ans.*	95	8	1
19.	3714	at	7¾		119	18	7½
20.	2759	at	8¼		97	14	3½
21.	5272	at	9		197	14	0
22.	6325	at	9¼		248	15	6¼
23.	3254	at	10½		142	7	3
24.	3256	at	11		149	4	8
25.	7972	at	11¾		390	5	11

CASE 3.

When the price is any number of shillings under 20.

RULE.

Multiply the quantity by the price for the answer in shillings; or,

If the price be even shillings, multiply by half the price, and double the right hand figure of the product for shillings, the rest of the product will be pounds; or,

If the price be an aliquot part of a pound, divide the given number by as many thereof as make a pound for the answer in pounds.

EXAMPLES.

26. What is the value of 527 bushels of corn, at 4s. per bushel?

Ans. £105 8s.

527	527	| 4 | ¼ | 527
4	2	
2(0)210(8	£105 8	£105 8
£105 8		

			s.		£	s.
27.	2271	at	5	*Ans.*	317	15
28.	2710	at	6		813	0
29.	191	at	8		76	8
30.	600	at	13		390	0
31.	1075	at	16		860	0
32.	2150	at	19		2042	10

CASE 4.

When the price is shillings and pence; or shillings, pence, and farthings.

RULE.

If the price be shillings and pence, and they the aliquot part of a pound, divide the given number by as many thereof as make a pound, for the answer in pounds; but,

If the price be not an aliquot part of a pound, then multiply the quantity by the shillings, and take parts of the rest, agreeably to Case 1 or 2, add them together, and their sum will be the answer in shillings.

EXAMPLES.

33. What will 2710 bushels of corn come to, at 6s. 8d. per bushel?

s.	d.		
6	8	$\frac{1}{3}$	2710

£903 6 8

34. What will 246 yards velvet come to, at 7s. 3d. per yard?

3	$\frac{1}{4}$	246
		7
		1722 value at 7s. per yard.
		61 6 value at 3d.

2(0)178(3 6

Ans. £89 3 6

			s.	d.		£	s.	d.
35.	378	at	1	8	*Ans.*	31	10	0
36.	126	at	3	4		21	0	0
37.	624	at	6	8		208	0	0
38.	327	at	5	$9\frac{1}{2}$		947	4	$6\frac{1}{2}$
39.	[illegible]	at	15	$7\frac{1}{2}$		1642	19	$4\frac{1}{2}$
40.	[illegible]2	at	17	$6\frac{3}{4}$		6280	7	0

CASE 5.

When the price is pounds, or, pounds, shillings, &c.

PRACTICE.

RULE.

Multiply the given quantity by the pounds, and take parts for the shillings, &c. or,

Reduce the pounds and shillings into shillings; and multiply the given quantity by the said shillings; take parts with the rest of the price, and add them together as before, and the sum will be shillings.

EXAMPLES.

41. 124 tons at £3 5s. 6½d. per ton.

s						
5	¼	124				
		3				
d		372				
6	1/10	31				
½	1/12	3	2			
		0	5	2		
		£406	7	2		

Or thus

6	½	124			
		65 = £3	5s.		
		620			
		744			
½	1/12	62			
		5	2		

2(0)812(7 2

£406 7 2

			£	s.	d.		£	s.	d.
42.	47	at	3	3	4	*Ans.*	148	16	8
43.	20	at	4	13	4		93	6	8
44.	71	at	6	13	4		473	6	8
45.	37	at	1	19	5¾		73	0	8¾
46.	2150	at	17	16	1½		38283	8	9

CASE 6.

When both the price, and the quantity, are of divers denominations.

RULE.

Multiply the price by the highest denomination, and take parts of the price of the remaining denominations, and add them together.

EXAMPLES.

47. What is the value of 21cwt. 3qr. 25lb. at $5 41cts. a cwt?

qr.		$	cts.	
2	½	5	41	
			21	
		5	41	
		108	2	
		113	61	
1	½	2	70	5
16lb.	¼	1	35	2+
8	⅛		77	2+
1	¼		38	6
			4	8+
		$118	87	3

	cwt.	qr.	lb.		$ cts.			$	cts.	m.
48.	12	2	14	of tobacco	at 9	25	a cwt. *Ans.*	116	78	1+
49.	25	3	14	of sugar	at 9	68	a cwt.	250	47	0
50.	17	1	17	of tallow	at 3	9	a cwt.	53	77	0+
51.	10	0	12	of tobacco	at 4	94	a cwt.	49	92	8+
52.	5	1	0	of sugar	at 7	12½	a cwt.	37	40	6+

				£ s. d.			£	s.	d.
53.	7	0	19	of tallow	at 3	16 0	a cwt.	27	4	10½
54.	7	1	14	of tobacco	at 3	15 9½	a cwt.	27	18	9½

	lb.	oz.		$ cts.		$	cts.	m.
55.	24	6	Troy	at 1	9	a lb.	26	70	5
56.	27	10		at 0	16½	a lb.	4	59	2+

	Yds.	qr.					
57.	121	2	at 0	71	a yd.	86	26	5
58.	68	1	at 1	1	a yd.	68	93	2+

	A.	r.	p.					
59.	240	1	19	at 2	4	an acre	490	23	7+

APPLICATION.

60. What is the value of 120lb. of rice, at 3d. a lb.?
Ans. £1 10s.

61. Bought 8012lb. of chalk, at 2¾d. a lb.?
Ans. £91 16s. 1d.

62. How much will 3906lb. of beef come to, at 7½d. a pound?
Ans. £122 1s. 3d.

63. What will 1847 yards of cloth come to, at 5s. 8d. a yard?
Ans. £523 6s. 4d.

64. If an ell of Holland cost 4s. 6d., what is the value of 5 pieces each 12 ells? *Ans.* £13 10s.

65. What is the value of 1234 yards of muslin, at 1s. 11½d. a yard? *Ans.* £122 2s. 3½d.

66. What cost 287 bushels of wheat, at 17s. 6d. a bushel?
Ans. £251 2s. 6d.

67. How much will 47 tons of hay amount to, at £6 6s. 8d. a ton? *Ans.* £297 13s. 4d.

68. Sold 26 acres of land, for £11 14s. an acre; what is the amount? *Ans.* £304 4s.

69. If 1 yard of cloth cost £1 19s. 4d., how much will 1677 yards come to? *Ans.* £3298 2s.

70. Sold 16cwt. 2qr. 17lb. of sugar, at £2 15s. 11d. a cwt. what was its value? *Ans.* £46 11s. 1d.

71. Sold 83yd. 2qr. of superfine cloth, at $8 24cts. a yard; how much does it amount to? *Ans.* $688 4cts.

72. If 1 acre of land be worth $29 57cts. what is the value of 578 acres 3 roods? *Ans.* $17113 63cts. 7m.+

TARE AND TRET.

Tare and Tret are allowances made to the buyer, on some particular commodities.

Tare is the weight of the barrel, box, bag, or whatever contains the articles or goods.

Tret is an allowance of 4lb. in every 104lb. for waste, dust, &c.

Gross is the weight of the goods, together with the barrel, box, bag, or whatever contains them.

TARE AND TRET.

en the tare is deducted from the gross, it leaves what is imes called the Suttle.

it is the weight of the goods, after all allowances are de-d.

CASE 1.

ıen the tare is so much in the whole gross weight.

RULE.

ɔtract the tare from the gross, the remainder will be neat.

EXAMPLES.

What is the neat weight of 14 hogsheads of tobacco, weigh-ɡether 456cwt. 1qr. 19lb. tare in the whole 15cwt. 2qr. 13lb.?

	Cwt.	qr.	lb.	
	456	1	19	gross.
	15	2	13	tare.
Ans.	440	3	6	neat.

What is the neat weight of 24 hogsheads of tobacco, each ıg 6cwt. 2qr. 17lb. gross, tare in the whole 17cwt. 3qr.

	Cwt.	qr.	lb.	
	6	2	17	
				4×6=24
	26	2	12	
			6	
	159	2	16	gross.
	17	3	27	tare.
Ans.	141	2	17	neat.

ıat is the neat weight of 99cwt. 3qr. 18lb. gross, tare 2cwt. .? *Ans.* 96cwt. 3qr. 26lb.

at is the neat weight of 18 hogsheads of tobacco, each 7cwt. 3qr. 16lb. gross, tare in the whole 14cwt. 1qr. 21lb.? *Ans.* 127cwt. 2qr. 15lb.

ıt is the neat weight of 4 casks of indigo, the gross weight eing 4cwt. 2qr. 14lb.; the tare in the whole 1cwt. 0qr. *Ans.* 17cwt. 1qr. 2lb.

t is the neat weight of 4 casks of sugar, the gross weigh-s follows:

	Cwt.	qr.	lb.
No. 1	4	1	10
2	3	3	2
3	4	0	19
4	4	0	0

	qr.	lb.
Tare	1	8
	1	1
	1	4
	1	7

Ans. 15cwt. 0qr. 11lb.

CASE 2.

When the tare is so much per barrel, box, bag, &c.

RULE.

Multiply the number of barrels, boxes, &c. by the tare per barrel, box, &c. subtract the product from the gross, and the remainder will be the neat.

EXAMPLES.

7. What is the neat weight of 30 casks of rice, each weighing 2cwt. 3qr. 12lb. gross, tare 21lb. per cask; and what is the amount at $7 35cts. per cwt.?

Ans. { Neat wt. 80cwt. 0qr. 10lb.
{ Value $588 65cts. 6m.+

Cwt.	qr.	lb.	
2	3	12	
		5×6=30	
14	1	4	
		6	
85	2	24	gross.
5	2	14	tare.
80	0	10	neat.

lb.		
		21
		30
		—4
		28)630(22
		56
		—— 5cwt. 2 14
		70
		56
		—
		14
		—

$	cts.	
7	35	
		80cwt.
588	00	
	52	5
	13	1+
$588	65	6+ value.

lb.		
8	$\frac{1}{14}$	
2	$\frac{1}{4}$	

8. What is the neat weight of 8 hogsheads of tobacco, weighing gross 86cwt. 2 qr. 24lb. tare 100lb. a hhd.

Ans. 79cwt. 2qr. 8lb.

9. Sold 9 hogsheads of sugar, each 6cwt. 2qr. 12lb. gross, tare 86lb. a hhd. at $9 75cts. a cwt. what is the neat weight and value?

Ans. 52cwt. 2qr. 6lb. $512 39cts. 7m.

10. What is the neat weight, and value of 12 casks of raisins, each weighing 3cwt. 2qr. 10lb. gross, tare 20lb. a cask, at £2 14s. a cwt.? *Ans.* 40cwt. 3qr. 20lb. £110 10s. 1½d.

CASE 3.

When the tare is so much per hundred weight.

RULE.

Deduct from the gross such aliquot part or parts of it, as the tare is of a cwt. the remainder will be the neat. Or, multiply the pounds gross by the tare per cwt. and divide the product by 112; the quotient will be the tare, which deduct as before.

EXAMPLES.

11. In 12 butts of currants, each 7cwt. 1qr. 10lb., tare 16lb. per cwt., how much neat? *Ans.* 75cwt. 1qr. 27lb.

	Cwt.	qr.	lb.	
	7	1	10	
			12	
16 | ¼ |	88	0	8	gross.
	12	2	9	tare.
	75	1	27	

12. What is the neat weight of 9hhd. of tobacco, each weighing gross 8cwt. 3qr. 14lb., tare 16lb. a cwt.?

Ans. 68cwt. 1qr. 24lb.

13. In 83cwt. 3qr. gross, tare 20lb. a cwt., what is the neat weight? *Ans.* 68cwt. 3qr. 5lb.

14. What is the neat weight and value of 40 kegs of figs, gross 75cwt. 3qr. 14lb., tare 14lb. a cwt. at $2 31cts. a cwt.?

Ans. { Wt. 66cwt. 1qr. 16lb. Value, $153 36cts. 7m.

CASE 4.

When tret is allowed with tare.

RULE.

1. Find the tare as before directed, and subtract from the gross, and call the remainder suttle.

2. Divide the suttle by 26,* and the quotient will be the tret, which subtract from the suttle, and the remainder will be the neat weight.

EXAMPLES.

15. In a hogshead of sugar, weighing 10cwt. 1qr. 12lb. gross, tare 14lb. per cwt., tret 4lb. per 104lb., how much neat weight?

Ans. 8cwt. 2qr. 24lb.

Cwt.	qr.	lb.
10	1	12
4		
41		
28		
330		
83		
14 | ¼ | 1160		gross.
145		tare.

26)1015(39

78

235

234

1

or thus,

	Cwt.	qr.	lb.	
14 | ¼ |	10	1	12	gross.
	1	1	5	tare.
	26)9	0	7	suttle.
		1	11	
Ans. Cwt.	8	2	24	neat.

1015 suttle.
39 tret.

Ans. 976lb. neat.

16. In 27 bags of coffee, each 2cwt. 3qr. 17lb. gross, tare 13lb. a cwt., tret 4lb. on 104lb., what is the neat weight?

Ans. 66cwt. 2qr. 4lb.

* The reason of dividing by 26 is to shorten the operation of multiplying by 4 and dividing by 104, for 104÷4=26.

17. What is the neat weight of 17 chests of sugar, weighing 120cwt. 2qr. gross, tare 176lb., tret 4lb. on 104lb. ?

Ans. 12008lb. or 114cwt. 1qr. 12lb.

18. Sold 177cwt. 22lb. gross, tare 9lb. a cwt., tret 4lb. on 104lb. ; required the neat weight, and its amount at $9 25cts. a cwt.

Ans. { Wt. 156cwt. 2qr. 22lb.
Value, $1449 44cts. 1m.+

APPLICATION.

19. In 16 hogsheads of tobacco, each weighing 5cwt. 1qr. 19lb. gross, tare on a hhd. 100lb., how much neat weight ?

Ans. 72cwt. 1qr. 20lb.

20. In 8cwt. 3qr. 20lb. gross, tare 38lb., tret 4lb. on 104lb., how much neat weight ? *Ans.* [illegible]lb. neat.

21. In 14 hogsheads of tobacco, weighing gross 89cwt. 3qr 17lb., tare on a hogshead, 100lb., what is the neat weight and value at $4 75cts. a cwt. ?

Ans. { [illegible]. 77cwt. 1qr. 17lb.
Value, $367 65cts. 7m.+

22. What is the neat weight of 5 casks of sugar, weighing as follows ; viz. No. 1, 4cwt. 2qr. 14lb. gross, tare 21lb. ; No. 2, 3cwt. 0qr. 17lb. gross, tare 18lb. ; No. 3, 5cwt. 3qr. 10lb. gross, tare 1qr. 11lb. ; No. 4, 6cwt. 1qr. 16lb. gross, tare 27lb. ; No. 5, 3cwt. 2qr. 18lb. gross, tare 19lb. ; and what is the value, the three first at £2 4s. 7d. a cwt. and the other two at £2 17s. 6d. ?

Ans. { Wt. 22cwt. 2qr. 7lb.
Value £56 10s. 5¼d.+

23. Sold 12 butts of currants, at $9 20cts. each butt weighing 7cwt. 1qr. 10lb. gross ; tare 16lb. a cwt. what is the neat weight and amount ?

Ans. { Wt. 75cwt. 1qr. 27lb.
Value $694 51cts. 7m.+

THE DOUBLE RULE OF THREE.

In the Double Rule of Three, five numbers or terms are given, to find a sixth ; three of which are a supposition, and two, a demand.

RULE 1.

1. Place that number or term which is of the same name or kind with the answer in the third place.

2. Then take one term from the supposition, and one from the demand, both of the same name or kind, and place them with the third term, as directed in the Single Rule of Three.

3. Then proceed in the same manner with the two remaining terms.

4. Reduce the similar terms to the same denomination if necessary.

5. Multiply the terms in the second and third place together, and divide their product by the product of those in the first place: the quotient will be the answer or term sought.

PROOF.

By two statings of the rule of three: Or, invert the stating.

Note.—If either of the first terms, or both, will divide any of the three last, or can be divided by any of them, or by any other number without a remainder, the operation may be contracted by cancelling them, and using their quotients in their stead.

EXAMPLES.

1. If 6 men in 8 days, eat 10lb. of bread, how much will 12 men eat in 24 days: *Ans.* 60lb.

men 6 : 12 } : : 10lb.
day's 8 : 24 }

288
10

48)2880(60 *Ans.*
288

0

Contracted.

6, : 12, 2 } : : 10lb.
8, : 24, 3 }

6
10

60 *Ans.*

RULE 2.

Or; State the question, by placing the three terms of supposition in the following order.

1. Let that which is the principal cause of gain, loss, or action be put in the first place.

2. That which relates to time, distance of place, and the like, in the second place.

3. And the remaining one in the third place.

4. Place the other two terms under those which are of the same name.

5. If the blank fall under the third term, then multiply the first and second terms for a divisor, and the other three for a dividend.

6. If the blank fall under the first or second term, multiply the third and fourth terms for a divisor, and the other three, for a dividend.

EXAMPLES.

1. If 6 men in 8 days eat 10lb. of bread how much will 12 men eat in 24 days?

men	days		lb.	
6	: 8	: :	10	24
12	: 24			12
			6	288
			8	10
			48)	2880(60lb. as before.
				288
				0

2. Suppose 4 men in 12 days mow 48 acres; how many acres can 8 men mow in 16 days? *Ans.* 128 acres.

3. If 10 bushels of oats be sufficient for 18 horses 20 days, how many bushels will serve 60 horses 36 days? *Ans.* 60 bushels.

4. If 4 dollars be the hire of 8 men for 3 days, how many days must 20 men work for 40 dollars? *Ans.* 12 days.

5. If 200lb. be carried 40 miles for 40cts. how far may 20200lb. be carried for $60 60cts.? *Ans.* 60 miles.

6. If $100 in 12 months gain $6 interest, how much will $75 gain in 9 months? *Ans.* $3 37cts. 5m.+

7. If the tuition of 3 boys for two quarters of a year, be $40 20 cents, how much will the tuition of 60 boys amount to for $4\frac{1}{2}$ years? *Ans.* $7236.

8. If $100 in one year gain $3 50cts. interest, what sum will gain $38 50cts. in one year and a quarter? *Ans.* $880.

9. If $100 in 12 months gain $8 interest, in what time will $750 gain $480? *Ans.* 8 years.

10. If 2 men can do 12 rods of ditching in 6 days, how many rods may be done by 8 men in 24 days? *Ans.* 192 rods.

11. An usurer put out $186 to receive interest for the same and when it had continued 8 months, he received for principa and interest $193 44cts. I demand at what rate per cent. per annum he received interest? *Ans.* 6 per cent.

12. If a footman travel 240 miles in 12 days, when the days are 12 hours long, how many days will be required to travel 720 miles when the days are 16 hours long? *Ans.* 27 days.

13. If 3 masters, who have each 2 apprentices, in 5 weeks, each week 6 days, earn $360; how much will 5 masters, who have each 10 apprentices, earn in 8 weeks, each week $5\frac{1}{2}$ days,

their daily wages being the same; the masters working as well as apprentices? *Ans.* $1075 55cts.+

14. If 145 men can make a wall 32 feet high and 40 feet long, in 8 days; in how many days can 68 men build a wall 28 feet high of the same length? *Ans.* 4 days 22hr.+

QUESTIONS IN REDUCTION.

What is Reduction?

How are large numbers or names brought into less ones?

How are small numbers or names brought into greater ones?

How is Reduction proved?

How many shillings and pence make a dollar in sterling, and in each of the states?

What is the Federal value of an English guinea?

What is the Federal value of a French guinea?

What is the Federal value of a pennyweight of gold?

What is the Federal value of an ounce of silver?

What is the rule for changing the currency of each state into Federal money?

How do we change Federal money into the currency of each of the states?

QUESTIONS IN VULGAR FRACTIONS.

What is a Vulgar Fraction?

How is a vulgar fraction expressed?

Which term is called the numerator, and which the denominator?

When is a fraction said to be in its least or lowest term?

How is a fraction reduced to its lowest terms?

What is the common measure?

How is the value or quantity of a fraction reduced to the known parts of the integer?

QUESTIONS IN THE SINGLE RULE OF THREE.

What does the Single Rule of Three teach?

What proportion exists between the terms given and the one found?

Of the three terms given how many are the supposition, and what is the other one called?

In stating questions, what term must be placed in the third place?

What is the rule for placing the first and second terms?

When the first and second terms are not of the same denomination, what must be done with them?

What must be done with the third when it has different denominations?

After having reduced the three terms (if necessary) to their proper denominations, what further is to be done?

Which of the given terms, is the fourth or answer, like?

How is the Single Rule of Three proved?

How are questions in Inverse Proportion solved?

QUESTIONS IN PRACTICE.

What is Practice?

How may Practice be proved?

How is the table of the aliquot parts of a pound,—of a shilling,—of a penny,—of a dollar,—and of an cwt.?

What is understood by the aliquot part or parts of a number?

When the given price be a halfpenny or a farthing, how do we take parts?

How do we take parts when the given price is three farthings?

When a remainder occurs, how do we proceed with it?

When the given price is a penny or more, but less than a shilling, how are the parts taken?

How do we proceed when the price given is any number of shillings under 20?

When the price is shillings and pence; or shillings, pence, and farthings, how do we proceed?

When the price is pounds, or pounds, shillings, &c., what is the rule for obtaining the answer?

What is the rule when the price of an integer and the quantity, are of divers denominations?

QUESTIONS IN TARE AND TRET.

What are Tare and Tret?

What is Tare?

What is Tret?

What is Gross?

What is Suttle?

What is Neat Weight?

When the tare is so much in the whole gross weight, how is the neat weight found?

When the tare is so much per barrel, box, bag, &c. how is the neat weight found?

How is the neat weight found, when the tare is so much per cwt.?

How is the neat weight found when tret is allowed with the tare?

QUESTIONS IN THE DOUBLE RULE OF THREE.

What is the Double Rule of Three?

Of the five terms given, how many of them are suppositions?

In stating a question, which of the terms must be placed in the third place?

How are the other terms in the question placed?

What are done with similar terms?

Which terms should be multiplied together for a dividend, and which for a divisor?

By rule second, which of the three terms of supposition, should be put in the first place?

Which one in the second place? What in the third?

How should the remaining two be placed?

When the blank falls under the third term, which terms should be multiplied for a divisor, and which for a dividend?

When the blank falls under the first or second terms, which then are multiplied for the divisor, and which for the dividend?

INTEREST.

Interest is a consideration allowed for the use of money; relative to which there are four particulars, viz.

First, the *principal*, or sum at interest.

Second, the *time* the principal is at use.

Third, the *rate per cent.* or interest, of £100 or dollars, for one year.

Fourth, the *amount*, which is the sum of the principal and interest added together.

Interest is either Simple or Compound.

SIMPLE INTEREST.

Simple Interest is that which arises from the principal only.

CASE 1.

When the time is one year, and the rate per cent. is pounds or dollars only.

RULE.

Multiply the principal by the rate per cent. and divide the product by 100.

PROOF.

By the Double Rule of Three.

EXAMPLES.

Note 1.—When the principal consists of dollars, multiply by the rate per cent. the product will be the interest for one year in cents.

1. What is the interest of $542, for one year, at 7 per cent. per annum? *Ans.* $37 94cts.

Dols.
542
7
$37 94

2. What is the interest of $756, for one year, at 7 per cent per annum? *Ans.* $52 92cts.

3. What is the interest of $800, for one year, at 6 per cent. per annum? *Ans.* $48.

4. What is the interest of $326, for one year, at 7 per cent? *Ans.* $22 82cts.

Note 2. When the principal is dollars and cents, multiply by the rate per cent. and separate one figure at the right of the product (as a remainder or fraction); and what is left will be the interest for one year in mills.

When the principal is dollars, cents and mills, then cut off two for a remainder, and what is left will be mills.

5. What is the interest of $438 25cts. at 7 per cent. per annum? *Ans.* $30 67cts. 7m.

Dols.	cts.
438	25
	7
$30	67 7|5

6. What is the interest of $875 35cts. for one year, at 6 per cent. per annum? *Ans.* $52 52cts. 1m.

7. What is the interest of $527 14cts. for one year, at 7 per cent. per annum? *Ans.* $36 89cts. 9m.+

8. What is the interest of $375 74cts. 8m. for 1 year, at 5 per cent? *Ans.* $18 78cts. 7m.+

9. What is the interest of $1354 9cts. 3m. for 1 year, at 7 per cent.? *Ans.* $94 78cts. 6m.+

Note 3. When the amount is required, add the principal to the interest.

10. What is the amount of $273 15cts. for one year, at 7 per cent. per annum? *Ans.* $292 27cts.+

11. What is the amount of $173 71cts. for one year, at 7 per cent. per annum? *Ans.* $185 86cts. 9m.+

12. What is the amount of a bond for $387 50cts. for one year, at 6 per cent. per annum? *Ans.* $410 75cts.

13. What is the interest of £745 16s. for one year, at £7 per cent. per annum? *Ans.* £52 4s. 1¼d.

£	s.
745	16
	7
£52)20	12
20	
s.4)12	
12	
d.1)44	
4	
qr.1)76	

14. What is the interest of £800 for one year, at 7 per cent. per annum? *Ans.* £56.

15. What is the interest of £347 10s. for one year, at 6 per cent. per annum? *Ans.* £20 17s.

16. What is the interest of £211 5s. for one year, at 7 per cent. per annum? *Ans.* £14 15s. 9d.

17. What is the interest of £350 17s. 9d. for one year at 6 per cent. per annum? *Ans.* £21 1s. 0½d.+

18. What is the interest of £76 for one year, at 5 per cent. per annum? *Ans.* £3 16s.

19. What is the interest of £268 for one year, at 4 per cent. per annum? *Ans.* £10 14s. 4½d.+

20. What is the interest of £270 10s. 6d. for one year, at 5 per cent. per annum? *Ans.* £13 10s. 6¼d. +

21. What is the interest of £472 1s. for one year, at 7 per cent. per annum? *Ans.* £33 0s. 10¾d. +

CASE 2.

When there is a fraction, as ¼, ½, ¾, &c. in the rate per cent.

RULE.

Multiply the principal by the rate per cent.; to the product add ¼, ½, or ¾ of said principal, and divide by 100 for the interest required.

EXAMPLES.

22 What is the interest of $428 for one year, at 6¾ per cent. per annum? *Ans.* $28 89cts.

		Dollars.
½	½	428
		6¾
		2568
¼	½	214 for ½
		107 for ¼
		$28 89 cts.

23. What is the interest of $216 62cts. for one year, at 5½ per cent. per annum? *Ans.* $11 91cts. 4m. +

24. What is the interest of $478 34cts. for one year, at 6¼ per cent. per annum? *Ans.* $29 89cts. 6m. +

25. What is the interest of £855 17s. 6d. for one year, at 5¾ per cent. per annum? *Ans.* £49 4s. 3d. +

26. What is the interest of $300, for one year, at 6¼ per cent. per annum? *Ans.* $18 75cts.

27. What is the interest of $426 18cts. for one year, at 4½ per cent. per annum? *Ans.* $19 17cts. 8m. +

CASE 3.

When the interest of a given sum for several years, is required.

RULE.

Multiply the interest of the given sum for one year, by the number of years.

EXAMPLES.

28. What is the interest of £246 18s. for 5 years, at 4¼ per cent. per annum? *Ans.* £52 9s. 3¾d.

£	s.	
½ | 246	18	
	4½	
987	12	
61	14	6
£10)49	6	6
20		
s.9)86		
12		
d.10)38		
4		
qr.1)52		

Ans. £52 9 3¼

£	s.	d.	
10	9	10¼	interest for 1 year.
		5	years.

Or thus,

£	s.	d.
1049	6	6
		5 years.
£52)46	12	6
20		
s.9)32		
12		
d.3)90		
4		
qr.3)60		

29. What is the interest of $750 for 3 years, at 6 per cent. per annum? *Ans.* $135.

30. What is the interest of $538 for 3 years, at 7 per cent. per annum? *Ans.* $112 98cts.

31. What is the interest of $76 81cts. for 2 years, at 5 per cent. per annum? *Ans.* $7 68cts. 1m.+

32. What is the interest of $375 17cts. 6m. for 4 years, at 7 per cent. per annum? *Ans.* $105 4cts. 9m.+

33. What is the amount of $400 3cts. for 12 years, at 6 per cent. per annum? *Ans.* $688 5cts. 1m.+

34. What is the interest of £432 10s. for 3 years, at 5½ per cent. per annum? *Ans.* £71 7s. 3d.

35. What is the interest of $433 25cts. for 5 years, at 6 per cent. per annum? *Ans.* $131 47½cts.

36. What is the interest of a bond of $875 35cts. for 5½ years at 6 per cent.? *Ans.* $288 86½cts.+

37. What is the interest of $1711 15cts. for 2 years, at 5 per cent. per annum? *Ans.* 196 78cts. 2m.+

38. What is the interest of £397 9s. 5d. for 2¼ years, at 3½ per cent. per annum? *Ans.* £31 6s. +

39. What is the amount of a mortgage of $1250 which has continued 4 years, at 6 per cent. per annum? *Ans.* $1557 44cts.

CASE 4.

When the time is months, weeks, or days, less or more than a year.

RULE.

As the months, weeks, or days in a year,
Are to the months, weeks, or days in the time given;
So is the interest of the given sum for a year,
To the interest required.

Or, take the aliquot parts of the yearly interest, for the given parts of a year.

EXAMPLES.

40. What is the amount of $64 58cts. for 3 years, 5 months and 10 days, at 5 per cent. per annum? *Ans.* $75 70cts.

Mo.		Dols.	cts.	
		64	58	
			5	
4	$\frac{1}{3}$	322	90	interest for 1 year in cents.
			3	
		968	70	do. for 3 years.
1	$\frac{1}{4}$	107	63	do. for 4 months.
10 days	$\frac{1}{3}$	26	90	do. for 1 month.
		8	96	do. for 10 days.
		1112	19	or $11 12cts. $1\frac{9}{10}$m. interest.
			64	58 principal.
			75	70 amount.

41. What is the interest of $453 45cts., for 3 years and 4 months, at 6 per cent. per annum? *Ans.* $90 69cts.

42. What is the interest of $225 37½cts. for 4 years and 7 months, at 6 per cent. per annum? *Ans.* $61 97cts. 8m.+

43. What is the interest of £57 17s. 8d. for 3 months, at 6 per cent. per annum? *Ans.* 17s. 4¼d.+

44. What is the interest of $7500 for 4 months, at 7 per cent per annum? *Ans.* $175.

45. What is the interest of $400 for a week, at 5 per cent. per annum? As, 52 : 1 : : 20. *Ans.* 38cts. 4m.+

46. What is the interest of $427 13cts. for 16 weeks, at 4½ per cent. per annum? *Ans.* $5

47. What is the interest of $824 15cts. for 22 weeks, at 7 per cent. per annum? *Ans.* $24 40cts. 7m.+

48. What is the interest of $575 for 73 days, at 7 per cent. per annum? *Ans.* $8 5cts.

49. What is the interest of £240 for 120 days, at 4 per cent. per annum? *Ans.* £3 3s. 1¼d.+

50. What is the interest of $394 for 56 days, at 6 per cent. per annum? *Ans.* $3 62cts. 6m.+

51. What is the interest of $438 24cts. for 4 years, 9 months and 14 days, at 7 per cent. per annum?

Ans. $146 90cts. 7m.+

52. What is the interest of £71 3s. 11½d. for 1 year, 5 months, and 25 days, at 6 per cent. per annum?

Ans. £6 6s. 11½d.+

53. What is the amount of $221 75cts. for 3 years, 7 months, and 6 days, at 6 per cent. per annum?

Ans. $269 64cts. 7m.+

CASE 5.

To find the principal, when the amount, time, and rate per cent. are given.

RULE.

As the amount of 100 pounds, or dollars, at the rate and time given,
Is to the amount given;
So is 100 pounds, or dollars,
To the principal required.

EXAMPLES.

54. What principal, at interest for 5 years, at 6 per cent. per annum will amount to $650? *Ans.* $500

$	$	$	$
6	As, 130 :	650 :	100
5 years.			650
30 int. of $100 for 5 years.		130)65000(500 *Ans.*	
100		650	
130 amount of $100 for 5 years.			00

55. What principal, at interest for 10 years, at 6 per cent. per annum, will amount to £1300? *Ans.* £812 10s.

56. What principal at interest for 4 years, at 7 per cent. per annum, will amount to $576. *Ans.* $450

CASE 6.

To find the rate per cent. when the amount, time, and principal are given.

RULE.

As the product of the time and principal,
Is to 100 pounds or dollars;
So is the interest for the whole time,
To the rate per cent.

EXAMPLES.

57. At what rate per cent. per annum, will $500 amount to $650 in 5 years?

$	$
500 principal.	650 am't.
5 years.	500
2500	150 int.

$ $ $
As. 2500 : 100 : : 150
150

2500)15000(6 per cent. *Ans.*
15000

58. At what rate per cent. per annum, will £500 amount to £725, in 9 years? *Ans.* 5 per cent.

59. At what rate per cent. per annum, will $600 amount to $856 50cts. in 9 years and 6 months. *Ans.* 4½ per cent.

CASE 7.

To find the time, when the principal, amount, and rate per cent. are given.

RULE.

As the interest of the principal for one year,
Is to the whole interest;
So is one year,
To the time required.

EXAMPLES.

60. In what time will $500 amount to $725, at 5 per cent. per annum? *Ans.* 9 years.

$	$	$	$		yr.
500	725	As 25	: 225	: :	1
5	500		1		
25)00	225		25)225(9		
			225		

61. In what time will £540 amount to £734 8s. at 4 per cent. per annum? *Ans.* 9 years.

62. In what time will $837 amount to $1029 51cts. at $5\frac{3}{4}$ per cent. per annum? *Ans.* 4 years.

63. A testator left his son, besides providing for his education, &c. $1500, to receive the amount thereof at 6 per cent. per annum, when he should arrive at the age of 21 years, which his guardian then found to be $2332 50cts.—How old was the boy at his father's decease? *Ans.* 11yr. 9mo.

QUESTIONS IN INTEREST WITHOUT ANSWERS.

64. What is the interest of $286 for one year at 7 per cent.?

65. What is the interest of $94 35cts. for one year at 6 per cent.?

66. What is the interest of $816 8cts. for three years at 7 per cent.?

67. What is the interest of $731 for $2\frac{1}{2}$ years at 4 per cent.?

68. What is the interest of $16 75cts. for 8 years at $5\frac{1}{2}$ per cent.?

69. What is the interest of £76 17s. 4d. for one year at 7 per cent.?

70. What is the interest of £180 14s. for three years at 5 per cent.?

71. What is the amount of $371 6cts. for one year at 6 per cent.?

72. What is the amount of $8 15cts. 4m. for four years at 7 per cent.?

73. What is the amount of £914 6s. 8d. for $1\frac{1}{2}$ years at 6 per cent.?

74. What is the interest of $56 9cts. 4m. for three years and 7 months at 5 per cent.?

75. What is the amount of $80 for 9 months and 20 days at $5\frac{3}{4}$ per cent.?

76. What is the interest of $759 50cts. for 2 years 1 month and 27 days at 7 per cent.?

77. What is the interest of £109 for 7 weeks at $6\frac{1}{2}$ per cent.?

78. What is the interest of $15 for 21 days at 7 per cent.?

79. What is the amount of $143 14cts. for 2 years 5 months 18 days at 4½ per cent. ?

80. What is the interest of 84cts. 6m. for 2½ years at 6 per cent. ?

81. What is the amount of £307 18s. 9d. for 1 year 3 months 7 days at 5 per cent. ?

INTEREST ON NOTES, &c.

The following rule for casting interest on notes, &c. on which partial payments have been made, is according to the law established in Massachusetts, and which for simplicity and correctness is, perhaps, equal to any.

Compute the interest on the principal sum from the time when the interest commenced to the first time when a payment was made, which exceeds either alone or in conjunction with the preceding payment (if any) the interest at that time due; add that interest to the principal, and from the sum subtract the payment made at that time, together with the preceding payment (if any;) and the remainder forms a new principal; on which compute and subtract the payments, as upon the first principal; and proceed in this manner to the time of the final settlement.

EXAMPLES.

1. A bond or note dated 5th Mo. (May) 1st, 1807 was given for $1000, interest at 7 per cent. and there were payments endorsed on it as follows:

1st payment, 6th Mo. (June) 7th, 1808	$200
2d payment, 1st Mo. (January) 10th, 1809	500
3d payment, 9th Mo. (September) 1st, 1809	12
4th payment, 1st Mo. (January) 5th, 1810	8
5th payment, 5th Mo. (May) 1st, 1810	60
6th payment, 7th Mo. (July) 3d, 1811	320

I demand how much remains due on the 1st day of 5th Mo. (May) 1812.

Principal, 5th Mo. (May) 1st, 1807	$1000 00
Interest to 6th Mo. (June) 1808 (1yr. 1mo. 6d.)	77 00
Amount	1077 00
Paid 6th Mo. (June) 7th 1808, a sum exceeding the interest	200
New principal, 6th Mo. (June) 7th 1808	877
Interest to 1st Mo. (Jan.) 10th, 1809 (7mo. 3d.)	36 31

an. Carried to next page.

	Amount	913 31
Paid, 1st. Mo. (Jan.) 10th. 1809, a sum exceeding the int'st		500 00
New principal, 1st. Mo. (Jan.) 10th 1809		413 31
Interest to 5th. Mo. (May) 1st. 1810, (1y. 3m. 22d.)		37 92
	Amount	451 23
Paid, 9th. Mo. (Sept.) 1st. 1809, a sum less than the interest then due,	12 00	
Paid, 1st. Mo. (Jan.) 5th. 1810, do. do.	8 00	
Paid, 5th. Mo. (May) 1st. 1810, a sum greater	60 00	80 00
New principal, 5th. Mo. (May) 1st. 1810,		371 23
Interest to 7th. Mo. (July) 3d. 1811 (1y. 2m. 2d.)		30 45
	Amount	401 68
Paid, 7th. Mo. (July) 3d. 1811,		320
		81 68
Interest to 5th. Mo. (May) 1st. 1812, (9m. 29d.)		4 74
Remains due, 5th. Mo. (May) 1st. 1812,		86 42

2, A bond or note, dated 1st. Mo. (January) 4th. 1817, was given for $1000 interest at 7 per cent. on which were the following endorsements:

1st. payment, 2d. Mo. (February) 19th. 1818,	$200
2d. payment, 6th. Mo. (June) 29th. 1819,	500
3d. payment, 11th. Mo. (November) 14th. 1819,	260

I demand how much remains due on said note, the 24th. of 12th. Mo. (December) 1820? *Ans.* $231 26cts.

3. A bond or note, dated 2d. Mo. (Feb.) 1st. 1810, was given for $500, interest at 6 per cent. and there were payments endorsed upon it as follows, viz.:

	$ cts.
1st. payment, 5th. Mo. (May) 1st. 1810,	40 00
2d. payment, 11th. Mo. (Nov.) 14th. 1810,	8 00
3d. payment, 4th. Mo. (April) 1st. 1811,	12 00
4th. payment, 5th. Mo. (May) 1st. 1811,	30 00

How much remains due on said note the 16th. of 9th. Mo. (Sept.) 1811? *Ans.* $455 57cts.

4. A bond or note, dated 6th. Mo. (June) 4th. 1811, was given for $700, interest at 7 per cent. and there were payments endorsed upon it as follows:

1st. payment, 7th. Mo. (July) 9th. 1812,	$ 78
2d. payment, 11th. Mo. (Nov.) 27th. 1813,	147

3d. payment, 1st. Mo. (Jan.) 17th. 1814, $68
4th. payment, 1st. Mo. (Jan.) 30th. 1815, 400
I demand how much remains due on said note the 30th. of 5th. Mo. (May) 1815? *Ans.* $174 49cts.

The following method of calculating interest on accounts current, is extracted from Dilworth, improved by R. Wiggins.

"When you wish to close an account current, and intend to charge interest on every particular entry; the shortest and most accurate method is this:

Find the number of days from the time of the first charge, till the close of the account.

Proceed in the same manner with the second, third, &c. to the end.

Then multiply each sum respectively by its correspondent number of days.

Add all the several products together, and multiply their sum by the rate of interest per cent.; and lastly, divide said product by 36500, and the quotient will be the interest required."

Note 1—If you sell your merchandise on a stipulated credit, i. e. for three, six, or nine months, or whatever time may be agreed on; that time must be taken off, which is readily done by beginning to count the time of each charge, so much after its date.

Note 2—When a merchant in the city sells goods to a merchant in the country at three months credit, and the country merchant remits him money on account; on settling their accounts, the city merchant must take off the three months in charging interest, and the cash remitted must be reckoned from the date.

An account current of the latter kind, as follows, will exemplify the whole rule.

N B. It is not customary to reckon both the day the goods were bought and the day the settlement was made.

WILLIAM WARNER, sells goods to T. SHANDY.

1818.		$	cts.			$
Jan. 2,	Sundries, as per bill,	264	15	Rec'd April 16,		200
Feb. 7,	do.	147	18	June 20,		200
April 16,	do.	350	12	Aug. 14,		200
June 20,	do.	110	00	Oct. 19,		200
Aug. 14,	do.	75	25	Dec. 5,		100
Oct. 19,	do.	246	75	(1819.) March 1.		150
Dec. 5,	do.	59	16	N. B. interest 7 pr. ct.		

To close this account April 2, 1819; How stands the interest? which is indebted? and how much?

$	cts.				
264	15×365=96414	. 75		200×351=70200	cts.
147	12×329=48422	. 22		200×286=57200	
350	12×261=91381	. 32		200×231=46200	
110	00×196=21560	. 00		200×165=33000	
75	25×141=10610	. 25		100×118=11800	
246	75× 75=18506	. 25		150× 32= 4800	
59	16× 28= 1656	. 48		1050	223200
1252	61	288551	. 27		
		223200	. 00		
		65351	. 27		

N. B. Taking the difference of these two sums serves a two-fold process.

7 rate per cent.

365 | 00)4575 | 58 . 89($12 . 53cts. 3m. $\frac{439}{3650}$ interest [due W. Warner.

	$	cts.	
W. Warner's accept.	1252	. 61	
Interest	12	. 53	. 3
	1265	. 14	. 3
Credit	1050	. 00	. 0
Due	$215	. 14	3

N. B. I find the number of days for the first sum by adding the days of each month together—then the intervening days between the payments. I subtract successively from that number; which is much shorter and easier than to go through the whole time for each sum.

2. Suppose I hold an obligation against A B. of $150 at 7 per cent. dated December 5th, 1818; and on the first of May, 1819, he pays me $50; on the 17th of July following $10; on the 1st of January, 1820, he pays me $100. How stands the account between us on the 1st of May 1820?

Ans. I am overpaid on the obligation $1 62cts. 7m.

T. H. Leggett of New-York, sells goods to C. Barker of Poughkeepsie.

1819.		$ cts.	1819.	$
July 7,	Sundries, as per Bill,	324 45		
Sept. 12,	do.	147 03	Sept. 1. Cash	300
Dec. 1,	do.	301 40	1820 Jan. 3, do.	200
1820, March 18,	do.	75 36	March 18, do.	200
May, 4,	do.	163 41	Sept. 14, do.	300
Sept. 24,	do.	216 50		

due, Jan. 10th 1821, on said account, allowing his credit on the goods purchased; interest at 7

Ans. $233 68cts.

INSURANCE, COMMISSION, AND BROKAGE.

Insurance, Commission, and Brokage, are allowances made to insurers, factors and brokers, at a stipulated rate per cent. as a compensation for their services.

RULE.

Work as if to find the interest of the given sum for one year, at the proposed rate; or, if the rate be less than 1 per cent. take such aliquot part or parts of the interest at 1 per cent. as the rate is of a pound, or dollar.

1. What may a broker demand for brokage, when he sells goods to the value of £500 10s. 7d. and I allow him 7s. per cent.?

Ans. £1 15s. 0¼d.+

£	s.	d.
5)00	10	7
20		
s.0)10		
12		
d.1)27		
4		
qr.1)08		

		£	s.	d.	qr.	
5	¼	5	0	1	1	at £1 per cent.
2	1/10	1	5	0	1	
			10	0	0	
		£1	15	0	1	*Ans.*

2. What is the commission on £287 10s. at 3½ per cent?

Ans. £10 1s. 3d.

3. If I employ a broker to sell goods for me to the value of £2575 17s. 6d. what is the brokage at 4s. per cent.?

Ans. £5 3s. 0¼d.+

4. What is the insurance of an East India ship and cargo, valued at $84713 71cts. 6m. at 15¾ per cent.?

Ans. $13342 41cts.¾+

5. What is the commission on $312, at 12cts. per cent.

Ans. 37cts. 4m.+

6. If a broker is employed to buy a quantity of goods, to the value of $2175 87½cts., what is the brokage at 37½cts. per cent.?

Ans. $8 15cts. 9m.+

7. What is the brokage on $15734 46cts. at 1½ per cent?

Ans. $236 1ct. 6m.+

8. What is the insurance of a house, valued at $1853, at 75cts. per cent. ? *Ans.* $13 89¾cts.

COMPOUND INTEREST.

Compound Interest is that which arises from any principal and its interest put together, as the interest becomes due; and for this reason it is called Compound Interest.

RULE.

Find the amount of the given sum by Simple Interest for the first year, which will be the principal for the second year; then find the amount of that principal for the second year, and that will be the principal for the third year; and so on for any number of years.

From the last amount, subtract the given principal, and the remainder will be the compound interest.

EXAMPLES.

1. What is the compound interest of $500, for 3 years, at 7 per cent. ? *Ans.* $112 52cts. 1m.+

500 principal.
7 per cent.

35,00 interest for 1 year.
500

535 amt. for 1st year.
7

37,45
535

572,45 amt. for 2d year.
7

40,07,1(5
572,45

$612,52,1+ amt. for 3d year.
500 principal.

$112,52,1 compound interest for 3 years. *Ans.*

2. What is the compound interest of $450, for 3 years, at 7 per cent. per annum? *Ans.* $101 26cts. 9m.+

3. What is the amount of $550 75cts. for 3 years, at 6 per cent. per annum, at compound interest?

Ans. $655 95cts. 2m.+

4. What is the compound interest of $500, for 4 years, at 6 per cent. per annum? *Ans.* $131 23cts. 8m.+

5. What will $1200 amount to in 4 years, at 4½ per cent. at compound interest? *Ans.* $1417 37cts. 7m.+

6. How much will £400 amount to in 4 years, at 6 per cent. at compound interest? *Ans.* £504 19s. 9¼d.+

DISCOUNT.

Discount is an allowance made for the payment of a sum of money before it becomes due, according to a certain rate per cent. agreed on between the parties concerned.

The *Present Worth* of any sum, or debt, due some time hence, is such a sum, as, if put to interest, for that time, at a certain rate per cent. would amount to the sum, or debt.—

(See Case 5, Simple Interest.)

RULE.

As the amount of 100 pounds, or dollars, at the rate and time given,

Is to the whole debt;

So is 100 pounds or dollars,

To the present worth.

Subtract the present worth from the whole debt, and the remainder will be the discount.

PROOF.

Find the amount of the present worth for the time and rate proposed; which must equal the given sum or debt.

EXAMPLES.

1. What is the present worth, and what the discount of $500, payable in 10 months, at 5 per cent. per annum?

Ans. { Present worth $480.
Discount $20.

m.	m.	$		$	cts.	m.		$	$
As 12	: 10	: : 5	As	104	16	6	: :	500	: : 100
	5								500
12)50,00,0						m. 104166)50000000(480			
$4,16,6+									
$100									
$104,16,6	Am't. of $100 for 10mo.								

2. Bought goods to the value of $109 64cts. to be paid in 9 months; what present money will discharge the same, if I am allowed 6 per cent. per annum discount?

Ans. $104 91cts. 8m.+

3. What is the present worth of $161 10cts. for 19 months, discount at 5 per cent. per annum? *Ans.* $149 28cts. 2m.+

4. What is the present worth of $430 67cts. for 19 months, discount, at 5 per cent. per annum? *Ans.* $399 07cts. 8m.+

5. What is the discount of £112 12s. for 20 months, at 7 per cent. per annum? *Ans.* £11 15s. 3¹d.+

6. What is the present worth of $240, one half payable at 4 months, and the other half at 8 months, discount at 5 per cent. per annum? *Ans.* $234 16cts. 2m.+

7. What is the present worth of $100, one quarter due in 3 months, and the remaining three quarters in 5 months, discount at 7 per cent. per annum? *Ans.* $97 44cts. 4m.+

8. Bought goods amounting to $615 75cts. at 6 months credit; how much ready money must be paid, if a discount of $4\frac{1}{2}$ per cent. per annum be allowed? *Ans.* $602 20cts.+

9. What is the difference between the interest of $1204 at 5 per cent. per annum, for 3 years; and the discount of the same sum for the same time and rate per cent.? *Ans.* $137 60cts.

EQUATION.

Equation is a method of reducing several stated times, at which money is payable, to one mean or equated time.

RULE.

Multiply each payment by its time, add the several products together, and divide the sum by the whole debt; the quotient will be the answer.

PROOF.

The interest of the sum payable at the equated time, at any given rate, will equal the interest of the several payments for their respective times, at the same rate.

EXAMPLES.

1. A owes B 380 dollars to be paid as follows, viz. $100 in 6 months, 120 dollars in 7 months, 160 dollars in 10 months: what is the equated time for the whole debt? *Ans.* 8 months.

100	120	160
6	7	10
600	840	1600
		840
		600

380)3040(8
3040

2. C owes D 100 dollars, of which 50 dollars are to be paid at 2 months, and 50 at 4 months; but they agree that the whole shall be paid at one time: when must it be paid?

Ans. 3 months.

3. A merchant hath owing to him $300 to be paid as follows, $50 at 2 months, $100 at 5 months, and the rest at 8 months: and it is agreed to make one payment of the whole, when must that be made? *Ans.* 6 months.

4. B owes C $800, whereof $200 are to be paid at 3 months, $100, at 4 months, $300 at 5 months, and $200 at 6 months; but they agree to make one payment of the whole; I demand what time that must be? *Ans.* 4 months, 18 days.+

5. K is indebted to L a certain sum, which is to be discharged at 4 several payments; that is ¼ at 2 months, ¼ at 4 months, ¼ at 6 months, and ¼ at 8 months; but they agree to make one payment of the whole; the equated time is demanded?

Ans. 5 months.

6. A merchant purchased goods, to the amount of $2000, whereof 400 dols. are to be paid present, 800 dols. at 5 months, and the rest at 10 months; but they agree to make one payment of the whole; what is the equated time? *Ans.* 6 months.

BARTER.

Barter is the exchanging of one commodity for another, according to the price or value agreed upon by the parties concerned.

RULE.

Find the value of the commodity whose quantity is given; then find what quantity of the other at the proposed rate, can be bought for the same money; and it gives the answer.

EXAMPLES.

1. How much tea at 64cts. per lb. must be given in barter for 4cwt. of rice at 4½cts. per lb.? *Ans.* 31lb. 8oz. or ½lb.

lb.	cwt.	cts.
As 1	: 4	: : 4½
	112	
	448	
	4½	
	1792	
	224	
	$20.16 value of the rice.	

cts.	cts.	lb.
As 64	: 2016	: : 1
	1	
	lb.	oz.
64)2016	(31	: 8 *Ans.*
	192	
	96	
	64	
	32	
	16	
	oz.	
64)512	(8	
	512	

2. How much tea, at $1 12½cts. a lb. can I have in barter for 4cwt. 2qr. of chocolate, at 50cts. a lb.? *Ans.* 2cwt.

3. How much sugar, at 9cts. a lb. should be bartered for 6½cwt. of tobacco, at 14cts. a lb.? *Ans.* 10cwt. 0qr. 12lb. ⅘.

4. How much wheat, at $1 25cts. a bushel, must be given in barter for 50 bushels of rye, at 70cts. a bushel? *Ans.* 28 bushels.

5. How much rice, at $3 36cts. a cwt. must be bartered for 3½cwt. of raisins, at 5cts. a lb.? *Ans.* 5cwt. 3qr. 9lb.+

6. Suppose C has tea, at $1 6cts. a lb. ready money, but in barter he will have $1 25cts. a lb. and D has tobacco, worth 18cts. a lb. ready money; how much must he rate his tobacco a lb. to equal the tea in value? *Ans.* 21cts.+

7. A had 41cwt. of iron, at 30s. a cwt. for which B gave him £20 in money, and the rest in pork, at 5d. a lb.: how much pork must be given besides the £20? *Ans.* 1992lb.

8. How much sugar, at 8cts. a lb. must be given in barter for 20cwt. of tobacco, at $7 50cts. a cwt. ? *Ans.* 16cwt. 2qr. 27lb.

9. A and B barter: A has 320lb. of chocolate at 56cts. a lb. for which B is to give him $75 in money, and the rest in cotton, at 8cts. a lb.: how much cotton is B to give A?

Ans. 1302½lb.

10. How many dozen lb. of candles, at 64cts. a dozen, must be delivered in barter for 3cwt. 2qr. 16lb. tallow, at $4 62½cts. a cwt.? *Ans.* 26doz. 3lb.+

11. A and B barter: A has 41cwt. of hops, at $4 50cts. a cwt. for which B gave him $28 50cts. in money, and the rest in salt, at 80cts. a bushel: how much salt must B give A, besides the money? *Ans.* 195 bushels.

12. H has 281 bushels of wheat, at 11s. 7d. a bushel, for which M is to give him 40 bushels of rye, at 7s. 4d. a bushel; how much money must H receive? *Ans.* £1 16s. 9½d.

13. R gave to L 189 yards of linen, at 83cts. a yard for 42 yards of cloth; what was the cloth a yard? *Ans.* $3 73½cts.

14. A and B barter: A has 145 barrels of flour, at $8 a barrel, ready money, but in barter he will have $8¾; B has salt at $1¼ a bushel, ready money; how must B sell his salt a bushel in proportion to A's bartering price, and how many bushels are equal to A's flour? *Ans.* { B's bartering price $1 36cts. 7m.+ and must give A 928 bushels.

LOSS AND GAIN.

Loss and gain is a rule that discovers what is gained or lost in buying or selling goods; and teaches to rise or fall the price, so as to gain or lose so much per cent. or otherwise.

The questions in this rule are performed by the Rule of Three.

1. When the buying and selling prices are given to find what is gained or lost by selling.

RULE.

First, find the value of the commodity at the price it cost; then find its value at the price sold at: the difference between these will be the gain or loss: Or, As 1 yard, lb. &c.: is to the quantity given; so is the gain or loss on one yard, lb. &c. to the whole gain or loss.

2. To find what is gained or lost per cent.

RULE.

First, find the gain or loss by subtraction;—then,

As the prime cost; is to £100, or dollars; so is the gain or loss; to the gain or loss per cent.

3. To find at what rate goods must be sold, to gain or lose so much per cent.

RULE.

As £100 or dollars; are to £100 or dollars, with the profit added, or loss subtracted; so is the prime cost; to the gaining or losing price.

4. The gain or loss per cent. being known, to find what the goods cost.

RULE.

As £100 or dollars, with the gain per cent. added, or the loss per cent. subtracted; are to £100 or dollars; so is the selling price; to the prime cost.

5. When so much is gained or lost by selling goods at a certain rate, to find the gain or loss if sold at any other rate.

RULE

As the first price, is to the other price; so are £100 or dollars, (adding the gain per cent. or subtracting the loss per cent.;) to the gain or loss per cent.

If the answer exceeds £100 or dollars, the excess is the gain per cent.; if it is less than £100 or dollars, the deficiency is the loss per cent.

EXAMPLES.

1. A storekeeper sold 100 yards of silk, at $1 50cts. per yard, which cost him $1 25cts. per yard; how much did he gain by the sale?

$1	50		yd.	yd.		cts.
$1	25	As	1	: 100	: :	25
				25		
25 gained per yd.						

$25 00 *Ans.* Whole gain.

2. Bought 13cwt. of iron, at 28s. a cwt. and retailed it at 3½d. a lb.; what is gained in the whole? *Ans.* gained £4 4s.

Cwt.	cwt.	s.
As 1	: 18	:: 28
		18
		224
		28
	2(0)50(4	

£25 4 prime cost.

lb.	Cwt.	d.
As 1	: 18	:: 2½
		112
		2016
		3½
		6048
		1008
	12) 7056	
	2(0)58(8	
		29 8 sold for
		25 4
		£4 4 *Ans.*

3. A merchant bought 53 yards of silk, at $1 50cts. a yard, and afterwards sold it at $1 75cts. a yard; how much did he gain by the sale? *Ans.* $13 25cts.

4. A merchant bought 650lb. of sugar, at 10 cents a lb. and sold it at 12 cents a lb.; how much did he gain? *Ans.* $13.

5. Bought a piece of baize of 42 yards, for $11 81cts. and sold it at 31cts. a yard; what is the gain or loss on the whole piece? *Ans.* $1 21cts. gain.

6. If 1lb. of tobacco cost 16cts. and be sold for 20cts.; what will be the gain per cent.? *Ans.* $25.

7. If I buy 437 yards of muslin for 2s. 3½d. a yard, and sell at 2s. 8d. a yard; how much do I gain? *Ans.* £8 3s. 10½d.

8. If I buy tea at $1 a lb. and sell it again at 87½cts. a lb.; what is lost per cent.? *Ans.* 12½ per cent.

9. If 980lb. of merchandize are bought for $153 16½cts. and sold for $184 32cts.; I demand the profit on each lb.
Ans. 3cts. 1m.+

10. If 112lb. of iron cost $3 43cts. what must one cwt. be sold for, to gain $15 per cent.? *Ans.* $3 94cts. 4m.+

11. Bought a piece of shalloon, containing 34 yards, at 40cts. a yard, and sold it at 12½ per cent. loss; how much a yard was it to be sold for? *Ans.* 35cts.

12. Bought 7 tuns of wine, at $67 a hogshead, which I sell out again at 19 cents a pint; what is the whole gain, and the gain per cent.? *Ans.* { Whole gain 805dols. 28cts. / Gain per cent. 42dols. 92½cts.+

13. If 375 yards of broad cloth be sold for £490, and afford 20 per cent. profit: what did it cost a yard? *Ans.* £1 1s. 9¼d.+

14. By selling broad cloth at $3 25cts. a yard, I lose at the rate of 20 per cent.; what is the prime cost of said cloth a yard?
Ans. $4 6cts. 2½m.

15. Having sold a yard of cloth at 11s. 6d. I gained at the rate of 15 per. cent. but if I had sold it for 12s. what should I have gained per cent? *Ans.* 20 per cent. gain.

16. If by selling cloth at $2 50cts. a yard, there is gained 10 per cent.; what is the gain or loss, per cent. when it is sold at $2 10cts. a yard? *Ans.* $7 60cts. per cent. loss.

17. Bought a chest of tea, weighing 490 lb. for $326; and sold it for $370 10cts. what was the profit on each pound?
Ans. 9 cents.

18. Bought 90 gallons of wine, at $1 20cts. a gallon, but by accident 10 gallons leaked out; at what rate must I sell the remainder a gallon, to gain 12½ per cent. on the whole cost?
Ans. $1 51cts. 8m.+

19. How much per cent. is equal to 3s. 6d. on a pound?
Ans. 17½ per cent.

20. Having sold 12 yards of cloth for $14 25cts. and thereby gained 8 per cent.; what is the prime cost of a yard?
Ans. $1 09cts. 9m.+

FELLOWSHIP.

Fellowship is a rule, by which merchants, &c. trading in company with a joint stock, are enabled to ascertain each person's particular share of the gain or loss, in proportion to his share in the joint stock.

NOTE.—Also by this rule a bankrupt's estate may be divided among his creditors, &c.

Fellowship is either Single or Compound.

SINGLE FELLOWSHIP,

Is when the several stocks in company are considered without regard to time.

RULE.

As the whole sum, or stock,
Is to each partner's share in stock, &c.;
So is the whole gain or loss,
To his share of the gain or loss.

PROOF.

The sum of the several shares must equal the gain or loss.

EXAMPLES.

1. Three merchants trading together, gained $800; A's stock was $1200, B's $4800, and C's $2000, what was each man's share of the gain?

A 1200
B 4800
C 2000

$8000

$
As 8000 : { 1200 / 4800 / 2000 } : : 800 : { 120 A's share / 480 B's share / 200 C's share } Ans.

800 proof.

2. D, E, and F, trading together, gained £120; D's stock was £140, E's was £300, and F's £160; what was each man's share of the gain? *Ans.* D's share was £28, E's £60, F's £32.

3. A, B, and C freighted a ship with 108 tuns of wine; of which A had 48 tuns, B 36, and C 24; but by reason of stormy weather were obliged to cast 45 tuns overboard; how much must each man sustain of the loss?

Ans. A 20 tuns, B 15, and C 10.

4. Divide the number 360 into three parts which shall be to each other as 3, 4 and 5. *Ans.* 90, 120, and 150.

5. A captain, mate, and 16 seamen took a prize worth $4056; of which the captain is to have 11 shares, and the mate 6 shares; the remainder is to be equally divided among the sailors; how much is each person to receive?

	$	cts.
Ans. The captain	1352	
The mate	737	45+
Each sailor	122	90+

6. Four men traded with a stock of $2400; and they gained in 2 years, twice as much, and $160 more; A's stock was $400, B's $740, C's $820; what was D's stock, and how much did each man gain by trading?

		$	cts.	m.
Ans.	D's stock was $440 and A gained	826	66	6+
	B ———	1529	33	3+
	C ———	1694	66	6+
	D ———	909	33	3+

7. A, B, and C, traded in company: A put in $140, B $250, and C put in 120 yards of cloth at cash price; they gained $230,

of which C took $100 for his share of the gain: how did C value his cloth a yard, and what was A and B's part of the gain?

Ans. { C's cloth was $5\frac{1}{4}$ a yard.
A gained $45 06cts. 6m.+ and
B $83 33cts. 3m.+

COMPOUND FELLOWSHIP.

Compound Fellowship is when the respective stocks in company are considered with time.

RULE.

Multiply each man's stock by its time, and add the several products together; then,

As the sum of the products,
Is to each particular product;
So is the whole gain or loss,
To its share of the gain or loss.

EXAMPLES.

1. Three merchants traded together; A put in £120 for 9 months, B £100 for 16 months, and C £100 for 14 months; they gained £100; what is each man's share?

	£	m	
A's stock	120	× 9	= 1080
B's stock	100	× 16	= 1600
C's stock	100	× 14	= 1400
		Sum	4080

	Product.		£		s. d.	
Sum.	1080				26 9 $4\frac{3}{4}$	+ A's share.
As 4080 :	1600	: :	100	:	39 4 $3\frac{3}{4}$	+ B's share.
	1400				34 6 $3\frac{1}{4}$	+ C's share.

2. Three merchants traded together, with a capital of $1300: of which A put in $620 for 8 months; B $950 for 11 months, and C $730 for 13 months; and they gained $1800; what was each man's share?

		Dols.	cts.	m.
Ans.	A's share	358	55	$4\frac{54}{249}$
	B's ——	755	42	$1\frac{171}{249}$
	C's ——	686	02	$4\frac{24}{249}$

3. Three merchants joined in company; D put in stock £195 14s. for 3 months, E £179 18s. 3d. for 5 months, and F £59 14s

10d. for 11 months; they gained £364 18s.—what is each man's part of the gain?

		£	s.	d.	rem'd.
Ans.	D's share	99	18	7¼	75455
	E's ——	153	2	3½	28250
	F's ——	111	17	1	410812

4. A, B, and C, made a stock for 12 months; A put in at first $873 60cts. and 4 months after he put in 96 more; B put in at first $979 20cts. and at the end of 7 months he took out $206 40 cts.; C put in at first $355 20cts. and 3 months after he put in $206 40cts. and five months after that he put in $240 more. At the end of 12 months their gain is found to be $3446 40cts.; what is each man's share of the gain?

		$	cts.
Ans.	A's share	1334	82 $\frac{14}{29}\frac{8}{04}\frac{4}{04}\frac{8}{16}\frac{8}{16}$
	B's ——	1271	61 $\frac{13}{27}\frac{1}{04}\frac{9}{00}\frac{0}{00}\frac{8}{00}$
	C's ——	839	96 $\frac{8}{29}\frac{2}{04}\frac{8}{04}\frac{4}{16}\frac{8}{16}$

EXCHANGE.

Exchange is a rule by which the money of one state or country is reduced to that of another.

Par is equality in value; but the course of exchange is frequently above or below par.

Agio, is a term used to signify the difference, in some countries, between bank and current money.

Note.—A Spanish dollar is valued at 4s. 6d. sterling, and at 8s. New-York currency: 4s. 6d. sterling is therefore equal to 8s. New-York currency, and £100 of the former is equal to 177¼ of the latter. When exchange between England and New-York is at this rate, it is said to be at par.

DOMESTIC EXCHANGE.

Domestic Exchange is the changing of the currency of each state into that of any other.

RULE.

Work by the Single Rule of Three; thus,

As the value of a dollar in the currency given,
Is to the value of a dollar in the currency required;
So is the sum given,
To its value required.

Or, by the theorem in the following table:—

A TABLE,

Exhibiting the value of a dollar in each of the United States; and practical Theorems for changing the currency of any State, into that of any other.

To exchange from to	New-England States and Virginia.	Pennsylvania, Jersey, Delaware, and Maryland,	New-York and North Carolina.	South Carolina and Georgia.
* The New-England States and Virginia.	Dollar 6s. 0d.	Add one fourth.	Add one third.	Multiply by 7 and divide product by 9
Pennsylvania, N. Jersey, Delaware, and Maryland.	Subtract one 5th.	Dollar 7s. 6d.	Add one 15th.	Multiply by 28 & divide prod. by 45
New-York and North Carolina.	Subtract one 4th.	Subtract one 16th.	Dollar 8s. 0d.	Multiply by 7 & divide product by 12
South Carolina and Georgia.	Multiply by 9, & divide product by 7.	Multiply by 45 & divide product by 28.	Multiply by 12, & divide prod. by 7.	Dollar 4s. 8.

* The New-England States are, Main, New-Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

EXAMPLES.

1. What is the value of £750 Massachusetts currency in New-York? *Ans.* £1000.

s.	s.	£		
As 6	: 8	: : 750		
		20		
		15000		or thus,
		8		3)750
		6)120000		250
		2(0)2000(0		£1000 *Ans.*
		£1000 *Ans.*		

2. What is the value of £1500 Massachusetts currency, in New-York? *Ans.* £2000.

3. What is the value of £100 Pennsylvania currency, in New-Hampshire? *Ans.* £80.

4. What is the value of £933 6s. 8d. South-Carolina currency, in Pennsylvania? *Ans.* £1500.

5. What is the value of £120 8s. 3d. New-England currency, in New-York? *Ans.* £160 11s. 0d.

6. Reduce £116 10s. New-York currency, into Connecticut currency? *Ans.* £87 7s. 6d.

7. What sum in Pennsylvania currency is equal to £120 10s. in New-York? *Ans.* £112 19s. 4½d.

8. Change £112 7s. 3d. South-Carolina currency into Vermont currency. *Ans.* £144 9s. 3¾d.+

9. What is the value of £800 New-York currency, in Pennsylvania? *Ans.* £750.

10. Reduce £214 9s. 2d. New-Jersey currency into Massachusetts currency. *Ans.* £171 11s. 4d.

11. C of Rhode-Island owes D of Philadelphia £108 10s.: what sum must D draw for the amount? *Ans.* £86 16s.

12. A merchant in New-York, owes £180 to a planter in Virginia; what sum ought he to be charged with in the planter's books? *Ans.* £135.

13. A merchant in Virginia consigns to his agent in New-York, a quantity of tobacco; which, when sold, and all charges deducted, amounts to £625 6s.: what is the value thereof in Virginia currency; also in Federal money?

Ans. { £468 19s. 6d. Virginia currency.
{ $1563 25cts. Federal Money.

FOREIGN EXCHANGE.

Accounts are kept in England, Ireland, and the West-India Islands, in pounds, shillings, pence, and farthings: though the value of the denominations in these places is different.

RULE.

Find the various answers in Exchange, by the Single Rule of Three, or by Practice.

A TABLE OF DIFFERENT MONIES.

The value of Foreign Coins, &c. in Federal Money, as established by a late Act of Congress.

	Dols.	cts.	m.
Pound Sterling,	4	44	4
Pound of Ireland,	4	10	0
Pagoda of India,	1	94	0
Tale of China,	1	48	0
Mill-rea of Portugal,	1	24	0
Ruble of Russia,	0	66	0

	Dols.	cts.	m.
Rupee of Bengal,	0	55	5
The Guilder of Holland,	0	39	0
Mark Banco of Hamburgh,	0	33	5
Livre of France,	0	18	5
Real plate of Spain,	0	10	0

FRANCE.

12 Deniers	1 Sol,
20 Sols	1 Livre,
3 Livres	1 Crown.

PORTUGAL.

400 Reas	1 Crusadoe,
1000 Reas	1 Mill-rea.

ITALY.

12 Deniers	1 Sol,
10 Sols	1 Livre, Genoa,
5 Livres	1 Piece of eight at
6 Livres	1 do. of Leghorn,
6 Solidi	1 Gross,
24 Grosses	1 Ducat.

HOLLAND.

8 Pennings	1 Groat,
2 Groats	1 Stiver,
6 Stivers	1 Shilling,
20 Stivers	1 Florin or Guilder,
2½ Florins	1 Rix Dollar,
6 Florins	1 Flemish,
5 Guilders	1 Ducat.

DENMARK.

16 Shillings	1 Mark,
6 Marks	1 Rix Dollar,
32 Rustics	1 Copper Dollar,
6 Copper Dollars	1 Rix Dollar.

RUSSIA.

18 Pennings	1 Gros,
30 Gros	1 Florin,
3 Florins	1 Rix Dollar.
2 Rix Dollars	1 Gold Ducat.

SPAIN.

4 Marvadies Vellon, or 2½ Marvadies of Plate,	1 Quarte,
8½ Quartas, or 34 Marvadies Vellon,	1 Rial Vellon,
16 Quartas, or 34 Marvadies of Plate,	1 Rial of Plate,
8 Rial of Plate,	1 Piastre,
10 Rial of Plate,	1 Dollar,
8 Piastres,	1 Spanish Pistole.

EXAMPLES.

London receives a bill of Exchange from New-York for 7s. sterling; for how much Federal money was it drawn, ge being at par? *Ans.* $4194 88cts. 3m.+

s.	d.	£	s.	$	$	cts.	m.
As 4	6	: 943	17	: : 1	: 4194	88	8.

New-York is indebted to London $1474 80cts. what ster- n must be remitted, when the exchange is at par? *Ans.* £331 10s. 7d.+

A merchant in Boston is indebted to his factor in Ireland)s. 6d. Irish; how much Federal Money will discharge t? *Ans.* $371 15¼cts.

31 : £90 10s. 6d. : : 410cts. : $371 15¼cts.

In $168 10cts. how many pounds Irish? *Ans.* £41.

In 250 livres of France, how many dollars and cents? *Ans.* $46 25cts.

Reduce $87 10cts. into livres of France. *Ans.* 470+

What is the value of 241 guilders 14 stivers of Holland, in l Money? *Ans.* $94 26cts. 3m.

Reduce 1786 Reals of Plate of Spain to Federal money. *Ans.* $178 60cts.

How much Federal money is equal to 187 Mill-reas, 534 Portugal? *Ans.* $232 54cts. 2m.+

n $24.92cts. how many Mill-reas of Portugal? *Ans.* 20.+

n 641 Tales of China, how many cents? *Ans.* 94868.

How many Rupees of Bengal are equal to $54 39cts.? *Ans.* 98.

of New-York, is indebted to B of London, £1474 16s. y; how much sterling must be remitted, when the ex- s at 64 per cent.? *Ans.* £899 5s. 4½d.

£	£	£	s.	£	s.	d.
As 164	: 100	: : 1474	16	: 899	5	4½. *Ans.*

maica is indebted to London £1476 12s. 8d. sterling; w much currency will London be credited at Jamaica, exchange is at 36⅓ per cent.?

£	£	s.	£	s.	d.	£	s.	d.
100	: 136	10	: : 1470	12	8	: 2007	8	3½. *Ans.*

hat sum sterling will be equal to £260 8s. 6d. New- rency, exchange at 44 per cent.? *Ans.* £180 17s.+

ow much Pennsylvania currency is equal to £800 17s. ing, exchange at 67½ per cent.? *Ans.* £1341 9s. 4½d.+

New-York, ——————

30. Exchange for £452 10s. 6d. sterling.

Thirty days after sight of this my first of exchange, second and third of like tenor and date not paid, pay to Samuel Sims, or order, four hundred fifty-two pounds, ten shillings and sixpence sterling, value received; and place the same to account, as per advice from PETER SIMPSON.

To THOMAS LAMOTT, Merchant, London.

What is the value of this bill in New-York currency, exchange at 77½ per cent.? *Ans.* £803 4s. 7½d.+

31. A merchant in Rotterdam has a bill drawn on him for £673 16s. 8d. sterling; exchange at 33s. 4d. Flemish a pound sterling; how much Flemish must he pay? *Ans.* £1123 1s. 1½d.+.

Note.—To change current money to bank, say; As 100 with the agio added, is to 100 bank; so is the current money, to the bank required.

Note 2.—To change bank into current money, say; As 100 bank, is to 100 with the agio added; so is the bank given to the current required.

32. Change 794 guilders, 15 stivers, current money, into bank florins, agio 4¾ per cent. *Ans.* 761guild. 8stiv. 11 pennings.+

33. Change 761 guilders, 9 stivers, bank into current money, agio 4¾ per cent. *Ans.* 794 guilders, 15 stivers, 4 pennings.+

QUESTIONS IN INTEREST.

What is Interest, and how many parts are there belonging to it?

What are these parts called?

How many kinds of interest are there?

What is Simple Interest?

How is the interest found, when the time is one year, and rate per cent. pounds or dollars only?

When the principal is dollars, and we multiply by the per cent. what will the product be?

When the principal is dollars and cents, after multiplying by the rate per cent. how many figures must be cut off as a remainder, and what are those called that are left?

When the principal is dollars, cents, and mills, after multiplying by the rate per cent. how many figures should be cut off at the right hand?

How do we obtain the amount of a sum?

How is the interest found when there is a fraction in the rate per cent?

How is the interest found when it is required for several years?

When the interest is required for months, weeks or days, less or more than a year, how is it found?

How is the principal found when the amount, time, and rate per cent. are given?

How is the rate per cent. found when the amount, time, and principal are given?

How is the time found when the principal, amount, and rate per cent. are given?

How is the interest on notes computed?

What are insurance, commission and brokage?

What is the rule for finding the insurance, commission, &c.?

What is Compound Interest?

How is the Compound Interest of any sum, at a given rate and time, ascertained?

QUESTIONS IN DISCOUNT.

What is Discount?

What is the present worth?

How is the present worth of any sum, at a given rate and time, found?

How is the Discount obtained?

How is Discount proved?

EQUATION

What is meant by Equation of payments?

What is the rule for finding the Equation of time?

How is Equation proved?

BARTER.

What is Barter?

How are questions performed in Barter?

LOSS AND GAIN.

What is Loss and Gain?

How are questions in this rule performed?

When the buying and selling prices are given, how is the gain or loss determined?

When the prime cost and selling price are given, how is the gain or loss per cent. found?

When the prime cost is given, and a gain or loss per cent. proposed, how is the selling price ascertained?

When the selling price, and the gain or loss per cent. are given, how do we find what the goods cost?

When the gain or loss per cent. is given of goods sold at a certain price, how is the gain or loss per cent. found, if sold at another price?

FELLOWSHIP.

What is Fellowship?

How many kinds of Fellowship are there?

What is Single Fellowship?

How is the gain or loss of each partner's share ascertained, in Single Fellowship?

What is Compound Fellowship?

How is the gain or loss of each partner's share ascertained, in Compound Fellowship?

EXCHANGE.

What is Exchange?

What is par in Exchange?

What is Agio?

Give an example wherein the par of Exchange is said to be equal?

What is Domestic Exchange?

How is the currency of one state changed to that of another, retaining the same value?

How are accounts kept in England, Ireland, and the West Indies?

How is the currency of one country exchanged to that of another?

What is the value of foreign coins &c. in Federal money, as established by congress?

PROMISCUOUS QUESTIONS TO EXERCISE THE LEARNER IN THE FOREGOING RULES.

1. If 14lb. of sugar cost 13s. at what rate is that a cwt.? *Ans.* £5 4s.

2. Reduce £225 12s. New-York, or North-Carolina currency, to Federal money? *Ans.* 564 dols.

3. What is the interest of $187 15cts. for 2 years, at 6 per cent. per annum? *Ans.* $22 45cts. 8m.

4. How many sixpences are there in £160 15s. 6d.? *Ans.* 6431 sixpences.

5. A grocer has 34cwt. 2qr. 12lb. of sugar, and intends to divide it into parcels, each of which shall weigh 68 pounds; how many of these parcels will there be? *Ans.* 57.

6. In 29 guineas, at 28s. how many farthings? *Ans.* 38976qr.

7. What is the interest of $550 for 4 years, at 7 per cent. per annum? *Ans.* $154

8. Two men depart both from the same place, and travel the same road, the one 37 miles, and the other 45 miles every day;

I demand how many miles they are distant the 12th day after their departure? *Ans.* 96 miles.

9. How much will 4 pieces of linen containing, viz. 35½, 36, 37½, and 38 yards come to, at 79cts. a yard? *Ans.* $116 13cts.

10. Bought 40 tubs of butter, weighing 36cwt. 2qr. 14lb. neat, for $472 5cts.; paid cooperage 12cts. a tub; salt and labour $4 82cts. 8 mills; storage $6 46cts. I would know what it stands me in a lb. *Ans.* 11cts. 9m.

11. At 4½ per cent. what is the commission on 1525dols? *Ans.* $68 62cts. 5m.

12. How many quintals of fish at 2dols. a quintal, will pay for 140 tierces salt, at $4 70cts. a tierce? *Ans.* 329qu.

13. Change $1048 83¼cts. to New-York currency.
Ans. £419 10s. 7½d.+

14. The rents of a parish amount to £3500 and a rate is granted of £65 12s. 6d. what is that a pound? *Ans.* 4½d.

15. If 1cwt. of flax cost $15 75cts. what is that a pound?
Ans. 14cts.+

16. What is the neat weight of 20 barrels of figs, each weighing 3cwt. 1qr. 5lb. gross, tare 14lb. a barrel?
Ans. 63cwt. 1qr. 16lb.

17. If a debt of 120dols. due as follows, viz. 50dols. at 2 months, 40dols. at 5 months, and the rest at 7 months, be reduced to one payment, at what time must it be paid? *Ans.* 4¼ months.

18. If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses 24 days?
Ans. 120 bushels.

19. A gentleman sent a tankard to his goldsmith, that weighed 50 ounces 8 pennyweights, and ordered him to make it into spoons, each to weigh 2 ounces 16dwt.; how many spoons were made of the tankard? *Ans.* 18 spoons.

20. If a gentleman's income is $1250 a year, and he spends $2 42cts. a day, how much does he lay by at the year's end?
Ans. $366 70cts.

21. What is the interest of $756 25cts. 2m. for four weeks, at 4 per cent. per annum? *Ans.* $2 32cts. 6m.+

22. Bought 18cwt. of cheese, at 10dols. a cwt. which I sell out again at 12cts. a lb. what is the profit in the whole?
Ans. $61 92cts.

23. B and C traded in company; B put in $950 for 5 months, and C $735 for 6 months, and by trading they gained $275 18cts. 4m. what was each man's share of the gain?
Ans. { B's $138 17cts. 3m.+
C's $137 01ct. 0m.+

24. If £17 10s. 3¾d. be divided equally among 15 persons, what will each have? *Ans.* £1 3s. 4¼d.

25. A gentleman, dying, left £963 18s. to be divided in the following manner: viz., to the widow he gave one third part, and the remainder was to be divided equally among six children; what was each one's portion?

Ans. { £321 6s. widow's portion. £107 2s. each child's portion.

26. A tub, which holds 130 gallons, is supplied by a pipe which admits 16 gallons into it in 30 minutes; it also has a leak in the bottom, which lets out 10 gallons in the same time. Now if the water begin to come into the tub, when it is empty, in what time will it be filled? *Ans.* 10h. 50m.

27. What is the interest of $45 70cts. for 5 weeks, at 6 per cent. per annum? *Ans.* 26cts. 3m.+

28. Some sportsmen, having placed a fox 100 yards distant from two hounds, let them start together; the hounds ran 2½ times faster than the fox: I demand how far the fox ran before the hounds overtook him? *Ans.* 66⅔yd.

29. If I buy cloth for 75cts. a yard, how must I sell it a yard, to gain 25 per cent.? *Ans.* 93cts. 7½m.

30. If a pole, perpendicular to the horizon, of 50ft. 11 inches in length, when the sun is on the meridian, cast a shadow 98ft. 6in. long; what is the breadth of a river, running due east and west within 20 feet 6 inches on the north side of a steeple, 300 feet 8 inches high, which at the same time casts the extremity of its shadow 30 feet 9 inches beyond the stream?

Ans. 176yd. 2ft. 4in.+

31. What is the interest of $754 48cts. for 3 years, 7 months, and 12 days, at $5 per cent. per annum?

Ans. $136 43cts. 4m.+

32. A merchant began to trade with £25327; for 6 years together, he cleared £1253 per annum; the next 5 years he cleared £1729 per annum; but the last 4 years, had the misfortune to lose £3019 per annum: what was he worth at the 15 year's end? *Ans.* £29414.

33. If a field will feed 6 cows 91 days, how long will it feed 21 cows? *Ans.* 26 days.

34. Andrew had fine peaches, 9 of which were worth 6 cents; William had apples, 8 of which were worth 2 cents; I require the number of apples that William must give Andrew for 15 of his peaches? *Ans.* 40.

35. A farmer had 21 bushels of Indian corn, which he wished to mix with buckwheat, so that every bushel of the provender

should contain 13 quarts of Indian corn: I demand the quantity of buckwheat in the mixture? *Ans.* 30bush. 2pk. 6qt.+

36. Suppose a person's age to be 15yr. 19d. 11h. 37m. 45s how many seconds are there in it, allowing 365 days and 6 hours to the year? *Ans.* 475047465.

37. I sold a watch for $50 and by so doing, lost 17 per cent. whereas I ought, in trading, to have cleared 20 per cent.; how much was it sold under its value? *Ans.* $22 28cts. 8m.+

38. B buys of C a hogshead of coffee weighing gross 9cwt 2qr.; tare 12lb. a cwt. what is the neat weight of it, and how much did it amount to at 23 cents a lb.

Ans. { Neat weight, 8cwt. 1qr. 26lb. / Amount $218 50cts.

39. When hens are 9 shillings a dozen, what will be the price of 6 dozen of eggs, at 2 cents for 3 eggs? *Ans.* 48cts.

40. What is the compound interest of $246 41cts. for 3 years, at 6 per cent. per annum? *Ans.* $47 06cts. 8m.

41. What weight will a person be able to raise, who presses with the force of 168lb. on the end of an equipoised hand-spike 100 inches long, which meets a convenient prop exactly 7½in. from the end? *Ans.* 2072lb.

42. If a lever be 100 inches long, what weight, lying 7½ inches from the end resting on a pavement, may be moved with the force of 168lb. lifting at the other end of the lever?

Ans. 2240lb.

43. Two boys are playing tag, one boy has 6 rods the start, but the other boy can run 15 to his 13; I demand how far the hindermost boy must run before he will overtake the other one?

Ans. 45 rods.

44. When I sell a yard of muslin at 15d. I gain 30s. by the piece, and when I sell the yard at 14d. I gain 20s. by the same piece: I demand how many yards the piece contained?

Ans. 120.

45. When oats are 2s. a bushel, and Indian corn 4s. a bushel, what will be the amount of 37 bushels of provender at 3s. a bushel? *Ans* £5 11s.

46. A certain apple tree will bear apples sufficient to make 55 gal. of cider in a year; how much can be made in 6 years from an orchard consisting of 7 rows, and 11 trees in each row; supposing each tree to bear as well as that one?

Ans. 100 tuns, 3hhd. 21gal.

47. The United States pay 6 per cent. interest on part of their domestic debt, and supposing they could borrow money in Holland for 3½ per cent. how much would they gain annually, by

borrowing a million dollars in Holland, and applying it to the payment of said debt? *Ans.* $25000

48. What is the present worth of $5150, due in 4½ months, discounting at the rate of 8 per cent. per annum, and allowing 1 per cent. on the present worth for prompt pay? *Ans.* $4950

49. What is the sterling value of £477. 8s. 8d. New-York currency? *Ans.* £268 11s. 1½d.

50. A merchant at New-York buys 46 tuns of Port wine, which costs him $2576; the freight thereof from Port to New-York cost $204 44cts. the loading and unloading $26 66cts. customs $44 44cts. the charge of the cellar $17 77cts. and he would gain $1600 by the bargain; a gentleman comes to him and demands the price of 26 tuns of the said wine. Quere, what should he ask? *Ans.* $2526 $13\frac{8}{46}$cts.

51. There are 800 French crowns, at 4s. 6d. each, remitted to London, by a merchant in Paris; what is the value in pounds sterling? *Ans.* £180 sterling.

52. In what time will $600 gain $50 interest, when $80 gain it in 15 years? *Ans.* 2 years.

53. Laid out $240 in serges and shalloons; the value of the shalloons was $144, and the quantity of serge 237 yards, and for every two yards of serge there were three of shalloon; how many yards of shalloon were there, and what was the value of one yard of each sort?

Ans. { 355½ yards of shalloon.
{ 40cts. 5m.+ per yard.

54. What is the interest of $6374 75cts. for 2 years and 10 months at 7 per cent. per annum? *Ans.* $1264 32cts. 5m.+

55. Divide £297 2s. 3d. among 4 men, 6 boys, and give each man 3 times as much as one boy; what will each man share, and each boy?

Ans. { £16 10s. 1½d. = 1 boy's share.
{ £49 10s. 4½d. = 1 man's share.

Note.—The men have triple shares; therefore multiply the number of men by 3, and add the number of boys for an equal number of shares in the whole.

£	s.	d.		£	s.	d.	
4×3+6=18,	297	2	3÷18=	16	10	1½	= 1 boy's share.

56. Divide $183 94cts. among 4 men, 6 women, and 9 boys; give each man, double what is given to a woman, and each woman double what is given to a boy?

	$	cts.	m.	
Ans. {	4	97	1+	a boy's share.
	9	94	2+	a woman's share.
	19	88	4+	a man's share.

57. A and B depart from the same place, and travel the same road: but A goes 5 days before B at the rate of 20 miles

B follows at the rate of 25 miles a day; in what time and distance will he overtake A?

Ans. { B will overtake A in 20 days. and travel 500 miles.

58. Astronomers compute the earth's orbit, or track which it describes round the sun in 365 days 6 hours, to be about 596-900,000 miles; how far then a minute, must we be carried through the firmament by this wonderful motion? *Ans.* 1134 miles.+

59. Bought 60 pieces of Holland for three times as many dollars, and sold them for four times as many, but if they had cost me as much as I sold them for, what should I have sold them for to have gained after the same rate? *Ans.* $320

60. If I buy tallow at $35 a ton, how must I sell a ton, to gain by 10 tons, as much as 1 ton cost? *Ans.* $38 50cts.

61. A, B, and C, traded together; A put in $20, B and C put in $85, they gained $63 of which B took up $21, what did A and C gain, and B and C put in?

Ans. A gained $12 and C $30, B put in $35 and C $50.

62. Two men departed from one place; the one goes north 7 miles a day; the other south 11 miles a day; how far are they distant the 12th day after their departure? *Ans.* 216 miles.

63. A has coffee, which he barters with B at 10d. a lb. more than it cost him, against tea, which stands B in 10s. a lb. but puts it to 12s. 6d. I would know how much the coffee did cost at first. *Ans.* 3s. 4d.

64. Reduce £256 16s. 6d. of the currency of Georgia, to that of Virginia or New-England, Pennsylvania and New-York.

	£	s.	d.	
Ans.	330	4	0¾	+Virginia or New-England.
	412	15	1	+Pennsylvania.
	440	5	5	+New-York.

65. What is the interest of £197 10s. for 2 months at 6 per cent.? *Ans.* £1 19s. 6d.

66. My grandfather is 112 years of age, and my father just 64. I am not as old as my grandfather by 82 years; what is the difference in years between me and my father? *Ans.* 34 years.

67. As I was beating on the forest grounds,
Up starts a hare before my two greyhounds;
The dogs, being light of foot, did fairly run
Unto her fifteen rods, just twenty-one.
The distance that she started up before
Was fourscore sixteen rods just and no more:
Now this I'd have you unto me declare,
How far they ran before they caught the hare?

Ans. 336 rods.

68. If by selling hops at $8 75cts. a cwt. the planter clears 30 per cent. what was his gain per cent. when the same goods sold for $10 62½cts. ? *Ans.* $57 85cts. 7m.+

MENSURATION.

Note.—Perhaps it would be better for the scholar to turn forward and do Addition, Subtraction, Multiplication, Division—the 3d case in Reduction of Decimals, and the Square Root before Mensuration.

Mensuration consists in the nature and properties of lines, angles, surfaces and solids.

A *Point* is a small Dot, that has no parts or magnitude.

A *Line* has length but no breadth.

A *Superficies* or *Surface*, called also Area, has length and breadth but no thickness.

A *Solid* or *Cube* has length, breadth, and thickness.

A *Circle* is a round figure bounded by a line called the Circumference, equally distant from some point which is called the centre.

A *Diameter* is a line drawn through the centre of a circle, terminated by the circumference, and divides the circle into two equal parts called semicircles.

CASE 1.

Having the diameter of a circle to find the circumference, or the circumference to find the diameter, or either of them to find the area.

RULES.

I. As 7 is to 22, so is the diameter to the circumference ; Or, as 1 is to 3. 1416, so is the diameter to the circumference.

II. As 22 is to 7, so is the circumference to the diameter ; Or, as 3. 1416 is to 1, so is the circumference to the diameter.

III. Multiply half the circumference by half the diameter and the product will be the area.

Or multiply the square of the diameter by. 7854, and the product will be the area.

Or multiply the square of the circumference by. 079574, and the product will be the area.

EXAMPLES.

1. What is the circumference of a circle, whose diameter is 18 inches. *Ans.* 56¼ inches.

2. What is the circumference of the earth, the diameter being 7970 miles ? *Ans.* 25048 miles, 4fur. 22po.+

3. What is the diameter of a wheel, whose circumference is 18 feet 4 inches ? *Ans.* 5ft. 2-$\frac{11}{14}$in.

4. What is the area of a circle, whose diameter is 12 inches.
Ans. 113 inches.+

5. How many acres are there in a circle of one mile diameter?
Ans. 502A. 2r. 24p.+

Note.—The content of an ellipsis is found by multiplying the longer and the shorter diameter together, and their product by .7854

6. How many square inches are there in an elliptical board 15 inches long and 11 broad. *Ans.* 129 inches.+

CASE 2.

To find the solid content of a round stick of timber or marble, of equal bigness from end to end.

RULE.

Find the area of one end, which being multiplied by the length, gives the number of inches it contains.

Note.—If the diameter is given in inches, and the length in feet, divide by 144; but if the diameter and length are both given in inches, divide by 1728, and you have the number of solid feet; this note must always be attended to.

EXAMPLES.

7. What is the solid content of a round stick of timber of equal bigness from end to end, whose diameter is 28 inches, and length 25 feet? *Ans* $106\frac{12}{144}$ feet.

8. What is the solid content of a square stick of timber of equal bigness from end to end, whose diameter is 21 inches, and length 35 feet? *Ans.* $107\frac{87}{144}$ feet.

CASE 3.

To find the solid content of a Pyramid or tapering stick of timber, whether square or round, when one end is a point.

RULE.

Multiply the area of the larger end, by one third of its length, and the product will be the answer.

EXAMPLES.

9. What is the contents of a tapering square stick of timber 24 feet 9 inches long, 16 inches square at one end, and ending in a point at the other? *Ans.* $14\frac{96}{144}$ feet.

10. What are the contents of a tapering round stick of timber 30 feet long, 18 inches in diameter at one end, and ending in a point at the other? *Ans.* $17\frac{96}{144}$ feet.

CASE 4.

To find the solid contents of a tapering square stick of timber when the small end is not a point; or as it is generally called, a frustum of a pyramid.

RULE.

Square each end in inches, that is multiply each end by itself separately.

2. Multiply one end by the other; add these three products together, and multiply their sum by one third of the length, then divide this last product as directed in the former note.

EXAMPLES.

11. What are the contents of a tapering square stick of timber, whose larger end is 12 inches, whose less end 8 inches, and whose length is 30 feet? *Ans.* $21\frac{16}{144}$ feet.

12. What are the solid contents of a tapering square stick of timber, whose larger end is 15 inches, whose less end 9 inches, and whose length is 27 feet? *Ans.* $27\frac{81}{144}$ feet.

CASE 5.

To find the solid contents of a tapering round stick of timber whose smaller end is not a point, called a frustum of a cone.

RULE.

Multiply each diameter by itself separately; multiply one diameter by the other; add these three products together; multiply their sum by the length, annex two cyphers to the product, and divide by 382: the quotient will be the solid contents.

EXAMPLES.

13. What are the solid contents of a round stick of timber whose diameter at the larger end is 12 inches, at the smaller end 9 inches, and whose length is 30 feet? *Ans.* $18\frac{3}{14\frac{3}{4}}$ feet.

14. What are the solid contents of a round block of marble, whose diameter at the larger end is 23 inches, and at the smaller end 15 inches, and whose length is 34 feet 8 inches?

Ans. $69\frac{37}{144}$ feet.

CASE 6.

To find how many solid feet a round stick of timber, of equal thickness from end to end, will contain when hewn square.

RULE.

Take half of the diameter in inches and square it or multiply it by itself; this product being doubled and multiplied by the length, gives the content in inches.

EXAMPLES.

15. If the diameter of a round stick of timber be 18 inches, and its length 30 feet, how many solid feet will it contain when hewn square? *Ans.* $33\frac{1}{14\frac{1}{4}}$ feet.

16. If a round stick of timber 28 feet long and 22 inches diameter, be hewn square, how many solid feet will it contain?

Ans. $47\frac{8}{144}$ feet.

CASE 7.

To find how many square-edged boards of a given thickness can be sawn from a log of a given diameter.

RULE.

1. Find the solid contents of the log when made square by case 6:

2. Then say, As the thickness of the board, including the saw gap; is to 12 inches; so are the solid feet to the number of feet of boards.

EXAMPLES.

17. How many feet of square-edged boards, $1\frac{1}{2}$ inches thick, including the saw gap, can be sawn from a log 16 feet long and 18 inches in diameter? *Ans.* 144.

18. How many feet of square-edged boards, $1\frac{1}{4}$in. thick including the saw gap, may be sawn from a log 28 feet long and 24 inches in diameter? *Ans.* 384.

CASE 8.

To find the number of feet a board contains, when the length is given in feet and the breadth in inches.

RULE.

Reduce the length to inches; which, being multiplied by the width and divided by 144 will give the number of feet.

Or, multiply the length by the breadth and divide by 12.

EXAMPLES.

19. How many feet are contained in a board 16 feet long and 15 inches broad? *Ans.* 20 feet.

20. How many feet are contained in the following lot of boards? 14 boards, 15 feet long 13 inches wide; 8 boards, 17 feet long 17 inches wide; 23 boards, 18 feet long, 11 inches wide. And what is their value at $\$13\frac{1}{2}$ a thousand feet?

Ans. { Content $799\frac{2}{3}$ft. / Value \$10 79cts.+

OF GAUGING.

Gauging is finding the contents of any box, tub, cask, or other vessel.

Note. There is a great resemblance between measuring timber and gauging, the content of any box, tub, &c. is found by reducing the dimensions to solid or cubic inches.

CASE 1.

To find the content of a vessel or box in the form of a cube.

RULE.

Multiply the side by itself, and that product again by the side, (which is commonly called cubing it.) Then divide this last product for beer, by 282, the inches in a beer gallon; and for wine, brandy, cider, &c. by 231, the inches contained in a wine gallon.

EXAMPLES.

1. What are the contents, in wine and in beer gallons, of a cube whose side is 60 inches.

Ans. $\begin{cases} 935\ \frac{15}{231} \text{ wine gallons.} \\ 765\ \frac{270}{282} \text{ beer gallons.} \end{cases}$

2. Suppose a cube whose side is 82 inches, what is the solid content in wine and beer gallons?

Ans. $\begin{cases} 2386\ \frac{203}{231} \text{ wine gallons.} \\ 1955\ \frac{88}{282} \text{ beer gallons.} \end{cases}$

CASE 2.

To find the solid contents of a figure that has six sides, and the opposite sides parallel.

RULE.

Multiply the length by the breadth, and that product by the depth, and divide, as before, to bring beer gallons and wine gallons; and then, dividing by 2150 will give the number of bushels nearly.

EXAMPLES.

3. If the length of a box be 95 inches, the breadth 58 inches, and the depth 28 inches, how many bushels, how many wine gallons, and how many beer gallons does it contain?

Ans. $\begin{cases} 71\frac{103}{215} \text{ bushels.} \\ 667\frac{203}{231} \text{ wine gallons.} \\ 547\frac{36}{282} \text{ beer gallons.} \end{cases}$

4. If the length of a vat be 112 inches, breadth 72 inches, depth 48 inches, what will be the content in solid inches, in wine gallons, in beer gallons, in barrels of beer, and in bushels.

36gal. = 1bar. of beer. *Ans.* $\begin{cases} 387072 \text{ solid inches.} \\ 1675\frac{147}{231} \text{ wine gallons.} \\ 1372\frac{168}{282} \text{ beer gallons.} \\ 38\frac{6}{47} \text{ barrels of beer.} \\ 180\frac{72}{2150} \text{ bush. dry measure.} \end{cases}$

CASE 3.

To find the contents of a cask.

RULE.

To twice the square of the bulge diameter, add once the square of the head, and multiply that sum by the length, then, for beer, divide by 1077, and, for wine, by 882.

EXAMPLES.

5. What is the content of a cask whose bulge diameter is 32 inches, the head diameter 26, and the length 40, in wine and in beer measure?

Ans. $\begin{cases} 101\frac{383}{1077} \text{ beer gallons.} \\ 123\frac{174}{882} \text{ wine gallons.} \end{cases}$

6. Suppose the bulge diameter of a cask to be 40 inches, head diameter 36, and length 60, what is the content in wine and in beer measure?

Ans. $\begin{cases} 250\frac{519}{1077} \text{ beer gallons.} \\ 305\frac{744}{1312} \text{ wine gallons.} \end{cases}$

CASE 4.

To find the solidity or content of a sphere or globe.

RULE.

Multiply the cube of the diameter by .5236, and the product will give the solidity.

EXAMPLES.

7. What is the content of a globe whose diameter is 7 inches?

Ans. 179,5948 inches.

8. Suppose the earth to be spherical, and its diameter 7970 miles, what is its solidity? *Ans.* 265078559622.8 miles.

TO FIND THE BURTHEN OF SHIPS.

RULE.

Multiply the length of the keel in feet by the breadth of the mid-ship-beam and their product by the depth of the hold, divide the last product by 95 for merchant ships, and by 100 for ships of war, and the quotient is the answer in tons.

EXAMPLES.

1. If the keel of a ship be 95 feet in length, and the breadth of the mid-ship-beam 32, and the depth of the hold 16 feet; what is the burthen?

Ans. $\begin{cases} 512 \text{ tons as a merchant ship} \\ 486+ \text{ tons as a ship of war.} \end{cases}$

2. The proportions of Noah's Ark (Gen. vi. 15:) were as follows: length 300 cubits, breadth 50 cubits, and depth of the hold 30 cubits: Required its burthen, allowing the cubit to be 22 inches?

Ans. $\begin{cases} 29188+ \text{ tons as a merchant ship} \\ 27729+ \text{ tons as a ship of war.} \end{cases}$

PART II.

VULGAR FRACTIONS.

Having briefly introduced Vulgar Fractions immediately after Reduction, and given some general definitions, and a few problems in order to give some general idea of Fractions, I refer the learner to those general definitions in page 66.

Vulgar Fractions are either proper, improper, compound, or mixed.

1. A *proper fraction* is when the numerator is less than the denominator, as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{17}{36}$, &c.

2. An *improper fraction*, is when the numerator is equal to, or greater than the denominator, as $\frac{4}{4}$, $\frac{7}{3}$, $\frac{5}{5}$, $\frac{12}{11}$, &c.

3. A *compound fraction*, is a fraction of a fraction, connected by the word of, as $\frac{2}{3}$, of $\frac{1}{12}$, $\frac{1}{2}$ of $\frac{2}{3}$, of $\frac{3}{4}$, &c.

4. A *mixt number* consists of a whole number and a fraction, as $3\frac{1}{3}$, $14\frac{9}{13}$, $8\frac{7}{15}$, &c.

A whole number may be expressed like a fraction by drawing a line under it, and putting 1 for a denominator, as $8=\frac{8}{1}$, and $12=\frac{12}{1}$, &c.

REDUCTION OF VULGAR FRACTIONS.

CASE 1.

To reduce a fraction to its lowest terms.

RULE.

Divide the greater term by the less, and that divisor by the remainder, till nothing be left; the last divisor will be the common measure; by which divide both terms, for the fraction required: or,

Divide the terms by any number that will divide them both without a remainder, and divide the quotients in the same measure, and so on, till no number greater than 1 will divide them; the fraction is then in its lowest terms.

NOTE.—If the common measure be 1, the fraction is already at its lowest terms. Cyphers on the right hand of both terms may be rejected; thus $\frac{4000}{7000}=\frac{4}{7}$.

EXAMPLES.

1. Reduce $\frac{72}{96}$ to its lowest terms. *Ans.* $\frac{3}{4}$.

72)96(1
72

Com. measure 24)72(3
72

24)$\frac{72}{96}=\frac{3}{4}$

or thus, $\frac{12)}{72}=\frac{2)}{6}=\frac{3}{4}$

2. Reduce $\frac{72}{84}$ to its lowest terms. *Ans.* $\frac{6}{7}$.

3. Reduce $\frac{60}{125}$ to its lowest terms. *Ans.* $\frac{12}{25}$.

4. Reduce $\frac{182}{196}$ to its lowest terms. *Ans.* $\frac{13}{14}$.

Note.—For more examples in this case, see page 67.

CASE 2.

To find the least common multiple of two, or more numbers.

RULE.

1. Divide by any number that will divide two, or more of the

given numbers without a remainder, and set the quotients with the undivided numbers, in a line beneath.

2. Divide the second line, as before and so on, until there are no two numbers, that can be divided; then, the continued product of the divisors and quotients will give the multiple required.

EXAMPLES.

6. What is the least common multiple of 6, 8, 10, and 16?

2)6 8 10 16

4)3 4 5 8

3 1 5 2

Then $2\times4\times3\times5\times2=240$ *Ans.*

6. What is the least common multiple of 6, 8, & 9? *Ans.* 72.

7. What is the least common multiple of 3, 5, 8, & 10? *Ans.* 120.

8. What is the least number which can be divided by the 9 digits separately, without a remainder? *Ans.* 2520.

CASE 3.

To reduce several fractions to others of the same value, and to having a common denominator.

RULE.

Reduce the given fractions to their lowest terms; then multiply each numerator into all the denominators but its own, for its respective numerator; and all the denominators into each other, for a common denominator.

EXAMPLES.

9. Reduce $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$, to a common denominator.

Ans. $\frac{90}{120}$, $\frac{96}{120}$, $\frac{100}{120}$.

$3\times5\times6=90$
$4\times4\times6=96$ Numerators.
$5\times4\times5=100$
$4\times5\times6=120$ Common denominators.

10. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$, to a common denominator.

Ans. $\frac{32}{64}$, $\frac{48}{64}$, and $\frac{40}{64}$.

11. Reduce $\frac{7}{8}$, $\frac{9}{10}$, $\frac{11}{12}$, to a common denominator.

Ans. $\frac{840}{960}$, $\frac{864}{960}$, and $\frac{880}{960}$.

12. Reduce $\frac{7}{8}$, $\frac{3}{5}$, $\frac{6}{7}$, and $\frac{3}{15}$ to a common denominator.

Ans. $\frac{735}{840}$, $\frac{504}{840}$, $\frac{720}{840}$.

13. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{5}{7}$, and $\frac{1}{4}$, to a common denominator.

Ans. $\frac{168}{240}$, $\frac{120}{240}$, $\frac{200}{240}$, $\frac{60}{240}$.

CASE 4.

To reduce vulgar fractions to others having the least common denominator.

RULE.

1. By case 2nd find the least common multiple of the denominators for a common denominator.

2. Divide this common denominator by the denominator of each fraction, and multiply the quotient by the numerator, for a new numerator.

EXAMPLES.

14. Reduce $\frac{2}{3}$, $\frac{4}{5}$, and $\frac{14}{15}$, to fractions, having the least common denominator.

5)5 9 15

3)1 9 3 $\quad 5\times3\times3=45$

1 3 1

$45\div 5\times 3=27$
$45\div 9\times 5=25$ } *Ans.* $\frac{27}{45}$, $\frac{25}{45}$, $\frac{42}{45}$.
$45\div 15\times 14=42$

15. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, to fractions having the least common denominator. *Ans.* $\frac{3}{6}$, $\frac{4}{6}$, and $\frac{5}{6}$.

16. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$, to fractions having the least common denominator. *Ans.* $\frac{105}{120}$, $\frac{108}{120}$, and $\frac{110}{120}$.

17. Reduce $\frac{7}{8}$, $\frac{5}{8}$, $\frac{4}{5}$, and $\frac{3}{16}$, to other fractions having the least common denominator. *Ans.* $\frac{105}{120}$, $\frac{100}{120}$, $\frac{96}{120}$, $\frac{36}{120}$.

18. Reduce $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{1}{4}$, to fractions having the least possible common denominator. *Ans.* $\frac{8}{12}$, $\frac{10}{12}$, $\frac{3}{12}$.

CASE 5.

To reduce a mixt number to an improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and add the numerator to the product for a new numerator, which place over the given denominator.

EXAMPLES.

19. Reduce $12\frac{4}{9}$ to an improper fraction. *Ans.* $\frac{112}{9}$.

$12\frac{4}{9}$

$9+4$

112 new numerator.

9 denominator.

20. Reduce $12\frac{14}{17}$ to an improper fraction. *Ans.* $\frac{218}{17}$.
21. Reduce $19\frac{2}{3}$ to an improper fraction. *Ans.* $\frac{254}{13}$.
22. Reduce $12\frac{4}{5}$ to an improper fraction. *Ans.* $\frac{64}{5}$.
23. Reduce $100\frac{19}{50}$ to an improper fraction. *Ans.* $\frac{5019}{50}$.
24. Reduce $79\frac{12}{15}$ to an improper fraction. *Ans.* $\frac{1197}{15}$.

CASE 6.

To reduce an improper fraction to a whole or a mixed number.

RULE.

Divide the upper term by the lower.

Note.—This case, and case 3 prove each other.

EXAMPLES.

25 Reduce $\frac{219}{17}$ to its proper terms. *Ans.* $12\frac{15}{17}$.

17)219(12$\frac{15}{17}$
17
49
34
15
17

26. Reduce $\frac{141}{17}$ to its proper terms. *Ans.* $8\frac{5}{17}$.
27. Reduce $\frac{317}{19}$ to its proper terms. *Ans.* $16\frac{13}{19}$.
28. Reduce $\frac{298}{48}$ to its proper terms. *Ans.* $2\frac{34}{48}$.
29. Reduce $\frac{961}{17}$ to its proper terms. *Ans.* $56\frac{9}{17}$.
30. Reduce $\frac{24}{7}$ to its proper terms. *Ans.* $3\frac{3}{7}$.

CASE 7.

To reduce a compound fraction to a single one.

RULE.

Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

Note.—Like figures in the numerators and denominators may be cancelled; and frequently, others may be contracted by taking their aliquot parts.

EXAMPLES.

31. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction. *Ans.* $\frac{24}{60}=\frac{2}{5}$.

$2\times3\times4=24$ $\frac{2}{}$

$3\times4\times5=60$ $\frac{}{5}$

or cancelled $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}=\frac{2}{5}$ as before.

32. Reduce $\frac{2}{7}$ of $\frac{7}{8}$ of $\frac{3}{6}$ to a single fraction. *Ans.* $\frac{42}{336}=\frac{1}{8}$.
33. Reduce $\frac{3}{4}$ of $\frac{8}{9}$ of $\frac{9}{16}$ to a single fraction. *Ans.* $\frac{216}{576}=\frac{9}{16}$.

34. Reduce $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{7}{9}$ to a single fraction. *Ans.* $\frac{140}{360}=\frac{7}{18}$.
35. Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{3}$ to a single fraction. *Ans.* $\frac{60}{168}=\frac{5}{14}$.
36. Reduce $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{20}$ to a single fraction. *Ans.* $\frac{3003}{3360}=\frac{143}{232}$.

CASE 8.

To reduce the fraction of one denomination to a fraction of another, but greater denomination, retaining the same value.

RULE.

Make a fraction a compound one, by multiplying it by all the denominations between it and that to which it is to be reduced; which fraction reduce to a single one.

EXAMPLES.

37. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

$$\frac{5}{6}\text{of}\frac{1}{12}\text{of}\frac{1}{20}=\frac{5}{1440}=\frac{1}{288}\text{of a pound.}\quad \textit{Ans.}$$

38. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound. *Ans.* $\frac{1}{960}$.
39. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling. *Ans.* $\frac{1}{96}$.
40. Reduce $\frac{5}{8}$ of a cent to the fraction of a dollar. *Ans.* $\frac{1}{160}$.
41. Reduce $\frac{3}{8}$ of an ounce troy, to the fraction of a pound. *Ans.* $\frac{3}{96}$.
42. Reduce $\frac{3}{7}$ of a pound avoirdupois, to the fraction of a cwt. *Ans.* $\frac{3}{28}$.
43. Reduce $\frac{2}{13}$ of a pint of wine, to the fraction of a hogshead. *Ans.* $\frac{1}{819}$hhd.
44. Reduce $\frac{19}{11}$ of a minute, to the fraction of a day. *Ans.* $\frac{19}{15840}$.

CASE 9.

To reduce a fraction of one denomination to a fraction of another, but less, retaining the same value.

RULE.

Multiply the given numerator by the parts of the denominations between it and that to which it is to be reduced, for a new numerator, and place it over the given denominator; which reduce to its lowest terms.

Note.—This case and case 6th prove each other.

EXAMPLES.

45. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny.

$$5\times20\times12=\frac{1200}{1440}=\frac{5}{6}\text{d.}\quad \textit{Ans.}$$

46. Reduce $\frac{4}{1200}$ of a pound to the fraction of a penny. *Ans.* $\frac{1}{5}$d.
47. Reduce $\frac{1}{960}$ of a shilling to the fraction of a farthing. *Ans.* $\frac{1}{2}$qr.
48. Reduce $\frac{1}{160}$ of a dollar to the fraction of a cent. *Ans.* $\frac{5}{8}$ct.
49. Reduce $\frac{3}{271}$ of a lb troy, to the fraction of an ounce. *Ans.* $\frac{8}{65}$oz.
50. Reduce $\frac{3}{3920}$ of a cwt. to the fraction of a lb. avoirdupois. *Ans.* $\frac{6}{7}$lb.
51. Reduce $\frac{1}{756}$ of a hhd. to the fraction of a pint. *Ans.* $\frac{2}{189}$.
52. Reduce $\frac{1}{15840}$ of a day to the fraction of a minute. *Ans.* $\frac{1}{11}$.

CASE 10.

To reduce the value or proper quantity of a fraction to the known parts of the integer.

RULE.

Multiply the numerator by the known parts of the integer; and divide by the denominator.

EXAMPLES.

53. Reduce $\frac{7}{16}$ of an acre to its proper quantity. *Ans.* 1R. 30per.

7
4
16)28(1 rood
16
12
40
16)480(30 perches.
48
0

54. Reduce $\frac{3}{5}$ of a dollar to its proper quantity. *Ans.* 60cts.
55. Reduce $\frac{19}{40}$ of a shilling to its proper quantity. *Ans.* $5\frac{1}{43}$d.
56. Reduce $\frac{9}{11}$ of £5 9s. to its proper quantity. *Ans.* £4 13s. $5\frac{1}{11}$d.
57. Reduce $\frac{13}{18}$ of a ton weight to its proper quantity.
Ans. 3cwt. 0qr. 8lb. 9oz. $13\frac{1}{8}$dr.
58. Reduce $\frac{9}{17}$ of 10cwt. 1qr. 12lb. to its proper quantity.
Ans. 8cwt. 1qr. 25lb. 1oz. $7\frac{3}{17}$dr.
59. Reduce $\frac{4}{7}$ of a mile to its proper quantity.
Ans. 4fur. 125yd. 2ft. 1in. $2\frac{1}{7}$b.c.
60. Reduce $\frac{1}{3}$ of a month to its proper quantity.
Ans. 3 weeks 1 day 9 hours 36 minutes.

Note.—See more examples in this case, page 65.

CASE 11.

To reduce any given value, or quantity, to a fraction of any greater denomination of the same kind.

RULE.

Reduce the given quantity to the lowest denomination mentioned for a numerator: and the integer (or whole number) to the same denomination for a denominator.

Note.—If a fraction be given, multiply both parts by the denominator thereof, and to the numerator add the numerator of the given fraction.

EXAMPLES.

61. Reduce 13s. 4d. to the fraction of a pound.

13s. 4d. = 160d. 2

——=-£. *Ans.*

£1 = 20s. = 240d. 3

62. Reduce 10s. 6d. to the fraction of a pound. *Ans.* £$\frac{21}{40}$.

63. Reduce 4½d. to the fraction of a shilling. *Ans.* $\frac{3}{8}$s.

64. Reduce 9oz. 2dr. $\frac{4}{7}$ to the fraction of a lb. avoirdupois. *Ans.* $\frac{4}{7}$lb.

65. Reduce 3qr. 3lb. 1oz. 12dr. $\frac{4}{9}$ to the fraction of an cwt. *Ans.* $\frac{7}{9}$cwt.

66. Reduce 1 rood 30 poles to the fraction of an acre. *Ans.* $\frac{7}{16}$acre.

67. Reduce 2qr. nails $\frac{1}{9}$ the fraction of an English ell. *Ans.* $\frac{5}{9}$ E. E.

68. Reduce 6 furlongs 16 poles, to the fraction of a mile. *Ans.* $\frac{4}{5}$ mile.

69. Reduce 3 weeks 1 day 9 hours 36 minutes, to the fraction of a month. *Ans.* $\frac{1}{4}$ month.

PROMISCUOUS EXAMPLES.

70. Reduce $\frac{35.4}{1.6}$ to its proper terms. *Ans.* 19$\frac{12}{16}$.

71. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{8}$, and $\frac{7}{8}$, to a common denominator. *Ans.* $\frac{144}{288}$, $\frac{192}{288}$, $\frac{240}{288}$, and $\frac{252}{288}$.

72. Reduce 12lb. 3oz. to the fraction of a cwt. *Ans.* $\frac{1365}{1792}$.

73. Reduce $\frac{3728}{7000}$ to its lowest terms. *Ans.* $\frac{1}{2}$

74. Reduce $\frac{4}{5}$ of $\frac{11}{12}$ of $\frac{12}{25}$ to a single fraction. *Ans.* $\frac{330}{1500}$.

75. Required the value of $\frac{3}{14}$ of a mile. *Ans.* 1fur. 28po. 3$\frac{1}{7}$yd.

76. Reduce 12$\frac{7}{8}$ to an improper fraction. *Ans.* $\frac{103}{8}$.

77. Reduce 7 hours 12 minutes to the fraction of a day. *Ans.* $\frac{3}{10}$ day.

78. Reduce $\frac{9887}{30068}$ to its lowest terms. *Ans.* $\frac{47}{90}$.

79. Reduce $\frac{1}{288}$ of a pound to the fraction of a penny. *Ans.* $\frac{5}{6}$d.

80. Reduce $\frac{4}{6}$, 2$\frac{3}{5}$ and 4 to fractions of a common denominator. *Ans.* $\frac{25}{30}$, $\frac{78}{30}$, $\frac{120}{30}$.

81. Reduce $\frac{134}{25}$ to its equivalent or proper number. *Ans.* 5$\frac{12}{25}$.

82. Reduce $\frac{5}{8}$ of 5s. to the fraction of 21 shillings *Ans.* $\frac{25}{168}$.

83. Reduce $\frac{5}{9}$ of a lb. Avoirdupois to the fraction of an cwt. *Ans.* $\frac{560}{1008}$cwt.

84. Reduce $\frac{2}{3}$ of $\frac{4}{7}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{7}{9}$ of $\frac{15}{16}$ to a simple fraction. *Ans.* $\frac{5}{18}$.

85. Reduce $\frac{2}{5}$ of a shilling to its proper quantity. *Ans.* 4d. 3$\frac{1}{5}$qr.

86. Reduce 13$\frac{1}{2}$ to an improper fraction. *Ans.* $\frac{27}{2}$.

87. Reduce $\frac{4}{784}$ of an cwt. to the fraction of a lb. *Ans.* $\frac{4}{7}$lb.

88. Reduce $\frac{5}{6}$, $\frac{7}{10}$, $\frac{3}{4}$, and $\frac{4}{5}$ to fractions having the least common denominator. *Ans.* $\frac{50}{60}$, $\frac{42}{60}$, $\frac{45}{60}$, and $\frac{48}{60}$.

ADDITION OF VULGAR FRACTIONS.

RULE.

1. Reduce compound fractions to single ones, mixed numbers to improper fractions, and all to a common denominator.

2. Add all the numerators together, and place the sum over the common denominator, and it will be the sum of the fraction required.

3. When fractions are united with whole numbers, the sum of the fractions may be found and added to the whole numbers.

Note.—If the fractions be of different denominations, find their value separately, and add as in compound addition.

1. What is the sum of $2\frac{1}{3}$, $\frac{4}{5}$, and $\frac{1}{2}$ of $\frac{3}{4}$? *Ans.* $3\frac{61}{120}$.

First $2\frac{1}{3}=\frac{7}{3}$ and $\frac{1}{2}$ of $\frac{3}{4}=\frac{3}{8}$.

The fractions are now prepared for adding, and should stand thus—$\frac{7}{3}$, $\frac{3}{8}$, $\frac{4}{5}$.

$7\times8\times5=280$
$3\times3\times5=45$
$4\times3\times8=96$
421 Sum of numer.

Numerators. $\frac{1}{3}$, $\frac{4}{5}$, $\frac{3}{8}$, or thus,
$1\times5\times8=40$
$4\times3\times8=96$
$3\times3\times5=45$
2
$181=1\frac{61}{120}$

Then $3\times8\times5\times120$ Denominator.

$3\times5\times8=120$ $3\frac{61}{120}$ *Ans.*

Which, placed together, stand thus $\frac{421}{120}=3\frac{61}{120}$ the *Ans.*

2. Add $\frac{3}{8}$ and $\frac{4}{7}$ together. *Ans.* $1\frac{8}{21}$.
3. Add $\frac{1}{4}$, $\frac{3}{7}$, and $\frac{5}{6}$, together. *Ans.* $1\frac{73}{84}$.
4. Add $\frac{1}{5}$, $4\frac{1}{3}$, and $\frac{2}{6}$, together. *Ans.* $4\frac{14}{15}$.
5. Add $\frac{2}{7}$, and $\frac{2}{3}$ of $\frac{3}{4}$, together. *Ans.* $1\frac{1}{14}$.
6. Add $\frac{1}{9}$ of 95 and $\frac{1}{7}$ of 14, together. *Ans.* $43\frac{1}{12}$.
7. Add $12\frac{1}{2}$ $3\frac{2}{3}$ and $4\frac{3}{4}$ together. *Ans.* $20\frac{11}{12}$.
8. Add $\frac{4}{8}$, $7\frac{1}{3}$, and $\frac{1}{3}$ of $\frac{3}{4}$, together. *Ans.* $8\frac{3}{8}$.
9. Add $6\frac{7}{8}$ of $\frac{3}{10}$, $\frac{4}{7}$ of $\frac{1}{2}$, and $7\frac{1}{2}$, together. *Ans.* $13\frac{109}{112}$.
10. Add $\frac{7}{9}$ of a pound, to $\frac{3}{10}$ of a shilling. *Ans.* 15s. $10\frac{4}{15}$d.

$\frac{7}{9}$ of a £$=$15s. $6\frac{2}{3}$d.
$\frac{3}{10}$ of a s.$=$ 0s. $3\frac{3}{5}$d.

Add $\frac{2}{3}$ and $\frac{3}{5}$$=1\frac{4}{15}$.

s.	d.
15	6
0	3
	$1\frac{4}{15}$

s. 15 $10\frac{4}{15}$d. *Ans.*

11. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a shilling. *Ans.* 18s. 3d.

12. Add $\frac{3}{4}$ of a penny to $\frac{1}{9}$ of a pound. *Ans.* 2s. 3d. $1\frac{2}{3}$qr.
13. Add $\frac{1}{2}$ of a pound troy, to $\frac{7}{12}$ of an ounce.
Ans. 6oz. 11dwt. 16gr.
14. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong. *Ans.* 6fur. 28po.
15. Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together.
Ans. 2d. 14h. 30min.
16. What is the sum of $\frac{2}{7}$ of £15, £$3\frac{3}{7}$, $\frac{1}{3}$ of $\frac{5}{7}$ of $\frac{3}{5}$ of a pound, and $\frac{3}{7}$ of a shilling? *Ans.* £7 17s. $6\frac{6}{7}$d.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions as in addition, then subtract the less numerator from the greater, and place the difference over the common denominator.

NOTE. When the given fractions are of different denominations, reduce them to their proper values, and then subtract as in compound subtraction.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{5}{7}$. *Ans.* $\frac{1}{28}$.

$3\times7=21$, $5\times4=20$ Numerators. then $\frac{21}{20}$ subtract.

$4\times7=28$ Denominator. 1 *Ans.*

2. From $\frac{3}{7}$ take $\frac{2}{5}$. *Ans* $\frac{1}{35}$.
3. From $\frac{11}{12}$ take $\frac{2}{3}$. *Ans.* $\frac{1}{4}$.
4. From $5\frac{2}{3}$ take $\frac{9}{10}$. *Ans.* $4\frac{23}{30}$.
5. From $\frac{19}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$. *Ans.* $\frac{359}{420}$.
6. From $\frac{3}{8}$ of 76 take $\frac{2}{13}$ of 21. *Ans.* $9\frac{7}{13}$.
7. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19. *Ans.* $1\frac{7}{12}$.
8. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a shilling. *Ans.* 9s. 3d.
9. From $\frac{1}{2}$ of a shilling take $\frac{3}{4}$ of a penny. *Ans.* $5\frac{1}{4}$d.
10. From $\frac{3}{5}$ of an oz. take $\frac{7}{8}$ of a dwt. *Ans.* 11dwt. 3 gr.
11. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile. *Ans.* 1m. 2fur. 16p.
12. From 7 weeks take $9\frac{7}{10}$ days. *Ans.* 5w. 4d. 7h. 12m.
13. Borrowed £$5\frac{3}{8}$ paid $\frac{4}{7}$ of £$4\frac{1}{8}$ what remains?
Ans. £4 0s. 10d.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

Reduce compound fractions to single ones, and mixed numbers to improper fractions; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

EXAMPLES.

1. Multiply $\frac{4}{7}$ by $\frac{7}{8}$. *Ans.* $\frac{7}{10}$.

$4\times7=28$

$5\times8=40$ — which reduced to its lowest terms. $=\frac{7}{10}$

2. Multiply $\frac{4}{5}$ by $\frac{5}{6}$. *Ans.* $\frac{2}{3}$.
3. Multiply $\frac{4}{5}$ by $1\frac{1}{4}$. *Ans.* $\frac{5}{4}$.
4. Multiply $\frac{4}{7}$ by $\frac{9}{11}$. *Ans.* $\frac{4}{11}$.
5. Multiply $12\frac{3}{5}$ by 7. *Ans.* $88\frac{1}{5}$.
6. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$. *Ans.* $\frac{9}{16}$.
7. Multiply $8\frac{2}{3}$ by $9\frac{3}{4}$. *Ans.* $84\frac{1}{2}$.
8. Multiply $9\frac{1}{2}$ by $\frac{1}{2}$ of $\frac{2}{3}$. *Ans.* $3\frac{9}{16}$.
9. Multiply $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{3}{4}$ of $\frac{4}{9}$ of $\frac{5}{6}$. *Ans.* $\frac{1}{6}$.
10. Multiply $\frac{1}{2}$ of 7 by $\frac{3}{8}$. *Ans.* $1\frac{3}{4}$.
11. Multiply $2\frac{1}{3}$ by $1\frac{1}{7}$, and multiply the product by $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{3}$. *Ans.* $\frac{2}{3}$.

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions, if necessary, then invert the divisor, and proceed as in Multiplication.

EXAMPLES.

1. Divide $\frac{4}{9}$ by $\frac{7}{8}$. *Ans.* $\frac{32}{63}$.

$$\frac{4}{9}\div\frac{7}{8}=\frac{4}{9}\times\frac{8}{7}=\frac{32}{63}$$

2. Divide $\frac{4}{7}$ by $\frac{2}{3}$. *Ans.* $\frac{6}{7}$.
3. Divide $\frac{13}{16}$ by $\frac{7}{8}$. *Ans.* $1\frac{7}{14}$.
4. Divide $1\frac{1}{16}$ by $\frac{7}{16}$. *Ans.* $1\frac{1}{7}$.
5. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$. *Ans.* $\frac{5}{16}$.
6. Divide $3\frac{1}{8}$ by $9\frac{1}{2}$. *Ans.* $\frac{1}{3}$.
7. Divide $\frac{7}{8}$ by 4. *Ans.* $\frac{7}{32}$.
8. Divide 4 by $\frac{7}{8}$. *Ans.* $4\frac{4}{7}$.
9. Divide $4\frac{2}{5}$ by $\frac{2}{5}$ of 4. *Ans.* $2\frac{1}{10}$.
10. Divide $\frac{5}{9}$ of 4 by $4\frac{2}{9}$. *Ans.* $\frac{10}{41}$.

PROMISCUOUS QUESTIONS.

RULE.

1. Multiply $\frac{3}{4}$ of 8 by $\frac{7}{8}$ of 5. *Ans.* 21.
2. Add $\frac{2}{5}$, $\frac{9}{10}$, and $\frac{7}{8}$ of $5\frac{1}{8}$, together. *Ans.* $6\frac{9}{80}$.
3. Divide 5205 by $\frac{1}{5}$ of 91. *Ans.* $71\frac{1}{4}$.
4. Subtract $\frac{27}{80}$ from $\frac{11}{24}\frac{1}{6}$. *Ans.* 0 remains.
5. Add $\frac{4}{7}$ of a ton, to $\frac{8}{9}$ of a cwt. *Ans.* 12cwt. 1qr. 8lb. $12\frac{3}{7}$oz.
6. Multiply $\frac{1}{8}$, $5\frac{1}{8}$, $\frac{3}{11}$, and $\frac{11}{12}$ of $\frac{5}{16}$. *Ans.* $\frac{2}{3}$.
7. From £$\frac{1}{4}$ take $\frac{8}{10}$s. *Ans.* 4s. $1\frac{1}{5}$.
8. Divide $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{2}{5}$ by $\frac{1}{4}$ of $\frac{2}{3}$. *Ans.* $\frac{6}{5}$.

THE SINGLE RULE OF THREE IN VULGAR FRACTIONS.

DIRECT PROPORTION.

RULE.

Prepare the given terms, if necessary, and state them as in whole numbers: multiply the second and third terms together, and divide the product by the first: Or, Invert the first term and multiply the three together, as in Multiplication.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard cost $\frac{3}{10}$ of a dollar, what cost $\frac{7}{15}$ of a yard? *Ans.* 35 cents.

yd. yd. $ cancelled.

As $\frac{2}{5} : \frac{7}{15} :: \frac{3}{10}$ $\frac{\cancel{5}}{\cancel{2}} \times \frac{7}{\cancel{15}} \times \frac{\cancel{3}}{\cancel{10}} \times \frac{7}{20} = \frac{\cancel{3}\times 7}{\cancel{3}\times 20} = 35$cts.

Inverted, $\frac{5}{2} \times \frac{7}{15} \times \frac{3}{10} = \frac{105}{300} = 35$cts.

2. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a shilling, what will $\frac{7}{8}$ of a yard come to? *Ans* 2s. 4d.

3. If $\frac{3}{5}$ of a yard cost $\frac{7}{15}$ of a pound, what will $\frac{3}{14}$ of a yard come to? *Ans.* 3s. 4d.

4. If $\frac{2}{5}$ of a yard cost $\frac{7}{8}$ of a pound, what will $40\frac{3}{4}$ yards come to? *Ans.* £59 8s. $6\frac{1}{4}$d.

5. If $\frac{3}{4}$ of a yard of lawn cost 73$\frac{3}{8}$cts. what will $10\frac{1}{3}$ yards cost? *Ans.* $10 10cts. 9m.+

6. At $12\frac{1}{2}$ cents a lb. what will $4\frac{4}{5}$lb. of cheese cost? *Ans.* $55\frac{2}{4}\frac{2}{5}$cts.

7. If 2oz. of silver cost 16s. 5d. what cost $\frac{3}{4}$ of an oz.? *Ans.* 6s. 1d. $3\frac{1}{2}$qr.

8. If 1 dollar be worth $56\frac{3}{5}$d. what are 500dols. worth? *Ans.* £117 18s. 4d.

9. If $1\frac{1}{3}$ bushels of apples cost 39$\frac{1}{2}$cts. what is the value of $3\frac{3}{5}$ bushels? *Ans.* $1 01$\frac{3}{20}$cts.

10. If 8lb. of sugar cost 4s. $9\frac{3}{5}$d. how much is it a lb.? *Ans.* $7\frac{1}{2}$d.

11. If $\frac{3}{4}$ of an ell English be worth $\frac{2}{3}$ of 2dols. 28cts. what is the value of 7 ells. *Ans.* $17 73$\frac{1}{2}$cts.

12. If 1 yard of broadcloth cost $1 87$\frac{1}{2}$cts. what will 4 pieces, each containing $27\frac{3}{8}$ yards cost? *Ans.* $205 44cts. 9m.+

13. If $\frac{1}{3}$lb. less by $\frac{1}{8}$ cost $13\frac{1}{2}$d. what cost 14lb. less by $\frac{1}{7}$ of 2lb.? *Ans.* £4 9s. $9\frac{3}{11}$d.

14. If $3\frac{1}{2}$ times $3\frac{1}{2}$lb. cost $1\frac{1}{2}$ times £$1\frac{1}{2}$ what is the value of $\frac{1}{2}$ of $\frac{1}{2}$ of $12\frac{1}{2}$lb.? *Ans.* 7s 6d

15. If $\frac{1}{8}$ of a ship be worth $175 35cts. what part of her may be purchased for $601 20cts.? *Ans.* $\frac{3}{7}$ part.

16. A person having $\frac{3}{5}$ of a coal mine, sells $\frac{3}{4}$ of his share for £171 what is the whole valued at? *Ans.* £380.

17. A merchant had $5\frac{3}{9}$cwt. of sugar, at $6\frac{3}{4}$cts a lb. which he bartered for tea at $1\frac{1}{8}$ a lb.; how much tea did he receive for the sugar? *Ans.* 27lb.+

INVERSE PROPORTION.

EXAMPLES.

18. How much shalloon $\frac{3}{4}$ of a yard wide, will line $4\frac{1}{2}$ yards of cloth, $1\frac{1}{2}$ yards wide? *Ans.* 9 yards.

19. What quantity of shalloon, $\frac{3}{4}$ yard wide, will line $7\frac{1}{2}$ yards of cloth, $1\frac{1}{2}$ yards wide? *Ans.* 15 yards.

20. If 16 men finish a piece of work in $28\frac{1}{3}$ days, how long will 12 men require to do the same work? *Ans.* $37\frac{7}{9}$ days.

21. How many pieces of cloth at $20\frac{1}{8}$dols. a piece are equal to $240\frac{1}{4}$ pieces at $12\frac{1}{2}$dols. a piece? *Ans.* $149\frac{177}{1127}$ pieces.

22. If 3 men finish a piece of work in $4\frac{1}{2}$ hours, in how many hours will 10 men do the same work? *Ans.* $1\frac{7}{10}$ hour.

23. When wheat is at 66cts. a bushel, if the penny loaf weighs 7oz. what is it a bushel, when the penny loaf weighs $2\frac{1}{2}$oz.
Ans. $1 84cts. 8m.

DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

RULE.

Prepare the given terms, when necessary, by reduction; then proceed as directed in whole numbers; or,

Invert the dividing terms, and multiply the upper figures continually for the numerator, and those below for the denominator of the fractional answer.

EXAMPLES.

1. If $\frac{3}{4}$ yard of cloth $\frac{7}{8}$ yard wide, cost £$\frac{3}{5}$ what is the value of $\frac{4}{5}$, $1\frac{3}{4}$ yards wide of the same quantity? *Ans.* 13s. 4d.

$$\left.\begin{matrix} 3 & 5 \\ \text{-yd.} & : \; - \\ 4 & 8 \\ 7 & 7 \\ \text{-yd.} & : \; - \\ 8 & 4 \end{matrix}\right\} :: \frac{2}{\pounds\,5}$$

$$\frac{7}{16} \div \frac{21}{32} = \frac{224}{336} = \frac{2}{3} = 13\text{s. } 4\text{d.}$$

$$\frac{3}{4} \times \frac{7}{8} = \frac{21}{32}$$

$$\frac{5}{8} \times \frac{7}{4} \times \frac{2}{5} = \frac{70}{160} = \frac{7}{16}$$

Cancelled and Inverted.

$$\frac{4}{3} \times \frac{8}{7} \times \frac{5}{8} \times \frac{7}{4} \times \frac{2}{5} = \frac{2}{3}$$

2. If £600 principal, gain £33½ interest in 10¾ months, in what time will £100 gain £6¼. *Ans.* 1 year.

3. If 9 students spend $25⅞ in 18 days; what sum will 20 students spend in 30 days? *Ans.* $95 47cts.+

4. If 3 men receive 8\frac{8}{10}$ for 19⅓ days labour, how much must 20 men have for 100¼ days? *Ans.* $305 03cts. 4m.+

5. If two men in ¾ of a year expend $56¼, how much will defray the expenses of 3 persons for 5⅓ years at the same rate? *Ans.* $600.

DECIMAL FRACTIONS.

A Decimal Fraction is a fraction whose denominator is 1, with as many cyphers annexed as there are places in the numerator, and is usually expressed by writing the numerator only, with a point prefixed to it: thus, $\frac{5}{10}$, $\frac{75}{100}$, and $\frac{625}{1000}$, are decimal fractions, and are expressed by .5, .75, .625.

A mixed number, consisting of a whole number and a decimal as $25\frac{5}{10}$, is written thus, 25.5.

As whole numbers, counting from the right to the left, increase in a tenfold proportion; so decimals, counting towards the right, decrease in the same proportion, as exemplified in the following

TABLE.

Whole numbers.									Decimals.								
9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9
Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth part.	Hundredth part.	Thousandth part.	Ten Thousandth part.	Hundred Thousandth part.	Millionth part.	Ten Millionth part.	Hundred Millionth part.	Thousand Millionth part.

NOTE.—Cyphers annexed to decimals, neither increase nor decrease their value; thus, .5, .50, .500, being $\frac{5}{10}$, $\frac{50}{100}$, $\frac{500}{1000}$, are of the same value; but cyphers prefixed to decimals, decrease their value in a tenfold proportion, thus, .5, .05, .005, being $\frac{5}{10}$, $\frac{5}{100}$, $\frac{5}{1000}$, are of different values.

ADDITION OF DECIMALS.

RULE.

Place the given numbers according to their values; viz. tenths under tenths, hundreds under hundreds, &c. and add as in addition of whole numbers; observing to set the point in the sum exactly under those of the given numbers.

EXAMPLES.

.12	23.21	47.4	.15
.134	34.35	19.71	.75
.21	19.172	461.721	.92
.743	30.061	400.004	63.25
.345	9.92	7.1004	25.
.002	1.5	7.04	4.
1.554			

5. Add .15, 126.5, 650.17, 940.113 and 611.2561 together.
6. Add 2.1, 4.12, 15.4, 76.36, 120.16 and 425.04 together.

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers, as in addition, with the less under the greater, and subtract as in whole numbers; set the point in the remainder under those in the given numbers.

EXAMPLES.

From	125.54	14.674	719.1004
Take	95.50803	5.91	7.121
Rem.	30.03197		

4. From 480 take 245.0075. *Ans.* 234.9925.
5. From .145 take .09684. *Ans.* .04816.
6. From 270.2 take 75.4075. *Ans.* 194.7925.
7. From an unit, or 1, subtract the millionth part of itself. *Ans.* .999999.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in whole numbers, and point off in the product as many decimal places as there are in both factors.

If there are not as many places in the product as there are decimal places in the factors, prefix cyphers to supply the deficiency.

EXAMPLES.

1. Multiply .612 by 4.12.

4.12	
1224	
612	
2448	
2.52144	

2. Multiply 1.007 by .041.

.041	
1007	
4028	
.041287	

3. Multiply 37.9 by 46.5 — Product 1762.35
4. Multiply 2461 by .0529 — 130.1869
5. Multiply 7.353 by 3.5 — 25.7355
6. Multiply 4.001 by .004 — .016004
7. Multiply .00071 by .121 — .00008591
8. Multiply 4.1 by 1.42 — 5.822
9. What is the amount of 253.5 bushels of wheat, at 1.25 dolls. a bushel. *Ans.* 316.875 dolls. or $316 87½cts.

Note.—Multiplication of decimals may be contracted thus:—Write the units place of the multiplier under that figure of the multiplicand, whose place you would reserve in the product; and dispose of the rest of the figures in a contrary order to what they are usually placed in. In multiplying reject all the figures that are to the right hand of the multiplying digit, and set down the products, so that their right hand figures may fall in a straight line below each other; observing to increase the first figures of every line with what would arise by carrying 1 from 5 to fifteen, 2 from 15 to 25, &c. from the preceding figures when you begin to multiply; and the sum is the product required.

EXAMPLES.

1. Multiply 27.14986 by 92.41035, so as to retain only four decimal places in the product.

Contracted	Common way.
27.14986	27.14986
53014.29	92.41035
24434874	13574930
542997	8144958
108599	2714986
2715	10859944
81	5429972
14	24434874
2508.9280	2508.9280650510

2. Multiply 56.7534916 by 5.376928, and retain only five places of decimals in the product. *Ans.* 305.15943.
3. Multiply .8273 by 5.214, and retain three decimals in the product. *Ans.* 4.313.
4. Multiply 3.141592 by 52.7438, so as to have only four decimal places in the product. *Ans.* 165.6994.

DIVISION OF DECIMALS.

RULE.

Perform the operation as in integers or whole numbers.

Note 1.—The quotient must always have as many decimal places, as the dividend has more than the divisor: Or, in other words, there must be as many in the quotient and divisor as there are in the dividend.

2 When the dividend has not as many decimal places as the divisor, or will not contain it, annex cyphers to the right of the dividend, to supply the defect.

3 When the division is completed, if there is not a sufficient number of decimal places in the quotient, supply the deficiency by prefixing a cypher, or cyphers to it.

EXAMPLES.

1. Divide 77.4114 by 9.51

```
9.51)77.4114(8.14
     7608
     1331
      951
     3804
     3804
```

2. Divide 4.13 by 572.4

```
572.4)4.130000(.00721+
      40068
       12320
       11448
        8720
        5724
        2996
```

3.	Divide 19.25 by 38.5	*Ans.* .5
4.	Divide 234.70525 by 64.25	3.653
5.	Divide .1606 by .44	.365
6.	Divide .1606 by 4.4	.0365
7.	Divide .1606 by 44	.00365
8.	Divide 9. by .9	10.
9.	Divide .9 by 9.	.1
10.	Divide 1.0012 by .075	13.34+

Division of Decimals may be contracted thus;

Take as many of the left hand figures of the divisor as will be equal to the number of integers and decimals in the quotient, and find how many times they may be had in the first figures of the dividend as usual. Let each remainder be a new dividend; and for every such dividend, leave out one figure to the right hand of the divisor, carrying for the increase of figures cut off, as in contracted Multiplication.

Note.—When there are not so many figures in the divisor, as are required to be in the quotient, begin the operation with all the figures, as usual, and continue it till the number of figures in the divisor, and those remaining to be found in the quotient are equal, after which, use the contraction.

EXAMPLES.

1. Divide 721.17562 by 2.2257432. so as to leave three decimal figures in the quotient.*

Common way.

```
2.25743(2)721.17562(319.467
        677230
        ------
22574)43945
      22574
      -----
2257)21371
     20317
     -----
225)1054
    903
    ---
22)151
   135
   ---
2)16
  15
  --
```

```
2.257432)721.1756|2(319.467
677 296
--------
439460   |2
225743   |2
---------|--
213717   |00
203168   |88
---------|--
10548    |120
9029     |728
---------|---
1518     |3920
1354     |4592
---------|----
163      |93280
158      |02024
---------|-----
5        |91256
```

* It will be evident that the quotient will consist of 3 figures of integers, and 3 of decimals; then 6 figures on the left of the divisor must be taken for the first operation.

2. Divide 2508.928065051 by 92.41035, so as to have 4 decimal places in the quotient. *Ans.* 27.1498.

3. Divide 12.169825 by 3.14159 so as to have 5 places of decimals in the quotient. *Ans.* 3.87377+

REDUCTION OF DECIMALS.

CASE 1.

To reduce a vulgar fraction to a decimal.

RULE.

Annex as many cyphers to the numerator as are necessary, and divide by the denominator.

Note.—There must be as many decimal places in the quotient, as there are cyphers annexed to the numerator. When a compound fraction is given, first reduce it to a single one, and then to a decimal.

EXAMPLES.

1. Reduce $\frac{1}{8}$ to a decimal. *Ans.* 125.

```
8)1.000
  125
```

2. Reduce $\frac{1}{4}$ to a decimal. .25
3. Reduce $\frac{1}{2}$ to a decimal. .5
4. Reduce $\frac{3}{4}$ to a decimal. .75
5. Reduce $\frac{1}{25}$ to a decimal. .04
6. Reduce $\frac{1}{3}$ to a decimal. .33333+
7. Reduce $\frac{5}{26}$ to a decimal. .192307+
8. Reduce $\frac{11}{18}$ of $\frac{12}{13}$ to a decimal. .604395+
9. Reduce $\frac{371}{5184}$ to a decimal. .071577+

CASE 2.

To reduce any sum or quantity to the decimal of any given denomination.

RULE.

Divide the given sum or quantity, reduced to the lowest denomination mentioned, by the proposed integer, reduced to the same denomination; and the quotient will be the decimal required. Or,

Write the given numbers, from the least to the greatest, in a perpendicular column, and divide each of them by such a number as will reduce it to the next denomination, annexing the quotient to the succeeding number; the last quotient will be the decimal required.

EXAMPLES.

10. Reduce 12s. 6d. 3qr. to the decimal of a pound.

12

150

4

960)603.000000(.628125 decimal.

5760

2700

1920

7800

7680

1200

960

2400

1920

4800

4800

Ans. .628125.

or thus,

£	4 | 3.00
1	
20	12 | 6.7500
20	20 | 12.562500
12	
	.628125 decimal.
240	
4	
960	

11. Reduce 7s. 6d. to the decimal of a pound. *Ans.* £.375.
12. Reduce 12s. to the decimal of a pound. *Ans.* £.6.
13. Reduce 15s. 9d. 3qr. to the decimal of a pound. *Ans.* £.790625.
14. Reduce 16cts. 3m. to the decimal of a dollar. *Ans.* $.163.
15. Reduce 56cts. to the decimal of a dollar. *Ans.* $.56.
16. Reduce £34 16s. 7¾d. to a decimal. *Ans.* £34.8322916.+
17. Reduce 12gr. to the decimal of a lb. Troy. *Ans.* .002083.+
18. Reduce 12 drams to the decimal of a lb. avoirdupois. *Ans.* .046875.
19. Reduce 2qr. 14lb. to the decimal of a cwt. *Ans.* .625cwt.
20. Reduce 2qt. 1pt. to the decimal of a gallon. *Ans.* .625gal.
21. Reduce 2 gallons, 1 quart, to the decimal of a barrel, reckoning the barrel at 32 gallons. *Ans.* .07031bar.+
22. Reduce 3qr. 2na. to the decimal of a yard. *Ans.* .875yd.
23. Reduce 7min. to the decimal of a day. *Ans.* .00486day.+
24. Reduce 72 days to the decimal of a year, computing the year at 365 days. *Ans.* .1972qr.+
25. Reduce 52 days to the decimal of a year, computing the year at 365¼ days. *Ans.* .1423qr.+
26. Reduce ¾d. to the decimal of a shilling. *Ans.* .0625s

CASE 3.

To reduce a decimal fraction to its value.

RULE.

Multiply the decimal by the number of parts in the next less denomination, and cut off as many places for a remainder, to the right hand, as there are places in the given decimal. Then multiply the remainder by the next inferior denomination, and cut off the remainder as before; and so on through all the parts of the integer: and the several denominations standing on the left hand make the answer.

EXAMPLES.

27. What is the value of .5724 of a pound sterling?

	20	*Ans.* 11s. 5d. 1.5qr.
	11.4480	
	12	
	5.3760	
	4	
	1.5040	

28. What is the value of .461 of a dollar? *Ans.* 46cts. 1m.
29. What is the value of .75 of a pound? *Ans.* 15s.
30. What is the value of £.8525 of a pound? *Ans.* 17s. 0d. 2.4qr.+

31. What is the proper quantity of .86 of a cwt.?
Ans. 3qr. 12lb. 5oz. 1.92dr.

32. What is the value of .7 of a lb. Troy? *Ans.* 8oz. 8dwt.

33. What is the value of .71 of 4oz. Troy?
Ans. 2oz. 16dwt. 19.2gr.

34. What is the value of .761 of a day?
Ans. 18 hours 15 minutes 50.4 seconds.

35. What is the value of .67 of a league?
Ans. 2 miles, 0 furlongs, 3 poles, 1 yard, 3.6 inches.

36. What is the proper quantity of .07 of a barrel of 32gal.?
Ans. 2gal. 1.92pt.

37. What is the quantity of .4712 of an ell English?
Ans. 2qr. 1.424n.

38. What is the value of .3375 of an acre? *Ans.* 1R. 14per.

39. What is the value of .3 of a year? *Ans.* 109 days 12hr.

Note.—The addition and subtraction of Decimals of different denominations, may be performed, after the decimals are reduced to their proper quantities.

40. What is the sum of £.48 and .16s. reduced to their proper quantities? *Ans.* 9s. 9.12d.

41. What is the sum of .17 of a lb. Troy, and .84 of an ounce?
Ans. 2oz. 17dwt. 14.4gr.

42. What is the difference between £.17 and .7s.?
Ans. 2s. 8d. 1.6qr.

43. What is the difference between .41 of a day, and .16 of an hour? *Ans.* 9hr. 40min. 48sec.

SINGLE RULE OF THREE DIRECT IN DECIMALS

The operation both in Direct and Inverse Proportion, is the same as in whole numbers, regard being had to the right placing of the points.

EXAMPLES.

1. If 2.75 yards of cloth cost £4 13.5s. what are 12.25 yards worth? *Ans.* £20 16s. 6d.

	yds.		yds.		£	s.		£	s.	d.
As	2.75	:	12.25	: :	4	13.5	:	20	16	6

2. If 1.4lb. of mace cost 14.5s. what cost 75.31lb.?
Ans. £38 19s. 11d. 3.8qr.+

3. If 1.5oz. of silver be worth 7.8s. what is the value of 9.7lb.
Ans. £30 5s. 3d. 1.44qr.

4. If 1 47cwt. of sugar be worth $10 5cts. how much is 1.7lb. worth at that rate? *Ans.* 10cts. 3m.+

5. If 8.4lb. of tobacco cost $1.046; what cost 3hhds. each 1cwt. 2qr. 7.4lbs.? *Ans.* $191 04cts. 4m.+

6. What is the value of 3 pieces of cloth, each containing 21.5yd. at $1 53cts. a yard? *Ans.* $98 .68cts. 5m.

7. If 1pt. of wine cost 1.2s. what cost 12.5hhds. *Ans.* £378.

8. If 19 yards of linen cost 25.75dols. what will 435.5 yards come to? *Ans.* 590.217dols.+or 590dols. 21cts. 7m.+

9. A man bought 5.8 tons of oil, for $266, but by misfortune lost 50.9 gallons; how must he sell the remainder a gallon to be no loser? *Ans.* 18cts. 8m.+

10. Two men bartered, A had 40.7 yards of linen, for which B gave him 25.6 ells of Holland at 50.5cts. an ell. I demand the price of the linen a yard? *Ans.* 31cts. 7m.+

11. A bought 3cwt. 1.5qr. of cloves at 2.75s. a lb. which he afterwards sold for £60 11s. 6d. how much did he gain by the transaction? *Ans.* £8 12s.

12. A grocer bought 320.5lb. of coffee at 24½cts. a lb., and sold it immediately at 26.25cts. a lb., what was his whole gain and the gain per cent.? *Ans.* { Whole gain 5dols. 60.875cts. / Gain per cent. 7dols. 14cts. 2m.+

INVERSE PROPORTION.

13. How long will 3 men be in performing a piece of work which will occupy 5 men 40.5 days? *Ans.* 67.5 days.

14. How many men can do as much work in .4 of a month, as 16 can do in 1.5 month? *Ans.* 60.

15. What length of board 7.5 inches wide will make a square foot? *Ans.* 19.2in.

16. How much in length, of a piece of land that is 11.75 poles broad, will make an acre? *Ans.* 13.61+poles.

17. What sum has A at interest, when it yields as much in 7.5 months, as B's $450 does in 15 months? *Ans.* $900.

THE DOUBLE RULE OF THREE IN DECIMALS.

Questions in this rule are performed as in whole numbers, placing the points agreeably to former directions.

EXAMPLES.

1. If 3 men receive 15.75 dollars for 4.5 days labour, what must 8 men have for 9.25 days? *Ans.* $86 33.3cts.

If 3m. : 8m.
45d. : 9.25d. } $15.75=86.333+or 86dols. 33cts. 3m.+

2. If 2 persons receive 50.625cts. for 1 day's labour, how much should 4 persons have for 10.5 days? *Ans.* $10 63cts. 1m.+

3. If the interest of $76.5 for 9.5 months be $15.24 what sum will gain $6 in 12.75 months? *Ans.* $22 44cts.+

4. When 12 oxen graze down 16.25 acres of grass in 20 days, how much of the same pasture will suffice 24 oxen 100 days ?

Ans. 162.5 acres.

5. If a cellar 22.5 feet long, 17.3 feet wide, and 10.25 feet deep, be dug in 2.5 days, by 6 men working 12.3 hours a day; how many days of 8.2 hours, should 9 men take to dig another, measuring 45 feet long, 34.6 wide, and 12.3 deep ? *Ans.* 12 days.

QUESTIONS IN REDUCTION OF VULGAR FRACTIONS.

By what names are the different kinds of Vulgar Fractions called?

What is a proper fraction ?

What is an improper fraction ?

What is a compound fraction ?

What is a mixt number ?

How may a whole number be expressed like a fraction ?

How is a fraction reduced to its lowest terms ?

In reducing a fraction to its lowest terms, what is the last divisor called ?

When a fraction is to be reduced to its lowest terms, and the common measure is one, what is said of the fraction ?

When cyphers are on the right hand of both terms of a fraction, what is done with them ?

How is the least common multiple of two or more numbers found?

How are several fractions reduced to others, retaining the same value and having one common denominator ?

How are vulgar fractions reduced to others having the least common denominator ?

How is a mixt number reduced to an improper fraction ?

How is an improper fraction reduced to a whole or mixed number ?

How is a compound fraction reduced to a single one ?

How is the fraction of one denomination reduced to the fraction of another, but greater, retaining the same value ?

How is the fraction of one denomination reduced to the fraction of another, but less, retaining the same value ?

How is the value or proper quantity of a fraction reduced to the known parts of an integer ?

How is any given value or quantity reduced to the fraction of any greater denomination of the same kind ?

QUESTIONS IN ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION IN VULGAR FRACTIONS.

How are Vulgar Fractions added ?

How are fractions of different denominations added ?

How are vulgar fractions subtracted?
How are fractions of different denominations subtracted?
How are vulgar fractions multiplied?
How are vulgar fractions divided?

QUESTIONS IN DIRECT, INVERSE, AND DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

How are questions stated in Direct, Inverse, and Double Rule of Three in Vulgar Fractions?

After stating sums in Single Rule of Three direct in Vulgar Fractions how is the operation performed?

How is the operation performed in Inverse Proportion?

How is double Rule of Three performed?

QUESTIONS IN DECIMALS.

What is a decimal fraction, and how is it expressed?

What is a mixed number?

In what proportion do whole numbers increase, and decimals decrease, in counting from the unit's place?

What are said of cyphers, when placed to the right hand of a decimal?

What effect have they when placed to the left hand?

How must whole nnmbers and decimals be added, and where must the point be placed in the sum or amount?

What is the rule for doing sums in subtraction of decimals?

How are decimals multiplied, and what is the rule for placing the point in the product?

When there are not as many figures in the product as there are decimal places in the factors, what is to be done?

What is the rule for multiplying decimals by contraction?

How is division of decimals performed, and what is the rule for pointing off the decimals in the quotient?

How may the division of decimals be contracted?

QUESTIONS IN REDUCTION OF DECIMAL FRACTIONS, &c.

How is a vulgar fraction converted into a decimal?

How many decimal places must there be in the quotient?

How do we proceed when a compound fraction is given?

How is money, weight, or measures in different denominations reduced to the decimal of an integer?

How is the value of a decimal fraction found in the known parts of an integer?

What is observed in working sums in the Single and the Double Rule of Three in Decimals?

ALLIGATION.

Alligation is a rule for adjusting the prices and simples of compound quantities.

CASE 1.

To find the mean price of any part of the composition, when the several quantities and their prices are given.

RULE.

As the sum of the several quantities,
Is to any part of the composition;
So is their total value,
To its value.

PROOF.

The value of the whole mixture at the mean price must agree with the total value of the several quantities at their respective prices.

EXAMPLES.

1. If 6 gallons of wine at 67 cents a gallon, 7 at 80cts. and 5 at 120cts. a gallon, be mixed together, what is one gallon of this mixture worth?

Gal.		cts.
6	at	67 = 402
7	at	80 = 560
5	at	120 = 600
18		1562

Gal. Gal. cts. cts. m.
18 : 1 : : 1562 : 86 77+ *Ans.*

2. A grocer mingled several sorts of sugar as follows, viz. 75lb. at 10cts. a lb., 80lb. at 11cts., 90lb. at 13cts., and 55lb. at 14cts.; what is a pound of this mixture worth? *Ans.* $11\frac{21}{30}$cts.

3. If 19 bushels of wheat at 6s. a bushel; 40 bushels of rye at 4s. a bushel; and 12 bushels of barley at 3s. a bushel, be mixed together; what will a bushel of this mixture be worth?

Ans. 4s. $4\frac{1}{4}$d.+

4. A wine merchant mixes 12 gallons of wine, at 60cts. a gallon, with 24 gallons at 68cts., and 16 gallons at 78cts.; what is a gallon of this composition worth? *Ans.* 69cts. $2\frac{1}{2}$s.

5. If 4 ounces of silver worth 75cts. an ounce, be melted with 8 ounces worth 60 cents an ounce; what will 1 ounce of the mixture be worth? *Ans.* 65cts.

CASE 2.

When the prices of several simples are given, to find how much of each, at their respective rates, must be taken to make a compound or mixture at any proposed price.

RULE.

1. Write the rates of the simples under each other, and set the mean rate at the left hand of them.

2. Link each rate which is less than the mean rate, with one or more that is greater.

3. Take the difference between each rate and the mean price, and set it opposite to that rate with which it is linked.

4. If only one difference stand against either rate, it will be the quantity required at that rate; but if there be several, their sum will be the quantity.

Note 1.—If all the given prices be greater, or less, than the mean rate, they must be linked to a cypher.

2.—Different modes of linking will produce different answers.

EXAMPLES.

5. A goldsmith would mix gold of 18 carats fine, with some of 16, 19, 22, and 24 carats fine; so that the compound may be 20 carats fine; what quantity of each must be taken?

			oz.	ca. fine.		Proof.
Mean rate 20	16	4	4 of gold.	16		$16\times4=64$
	18	2	2 ———	18		$18\times2=36$
	19	2	2 ———	19	*Ans.*	$19\times2=38$
	22	2+1	3 ———	22		$22\times3=66$
	24	4	4 ———	24		$24\times4=96$
			15			300

15)300(20 car. fine.
300

6. How much rye at 50cts. a bushel, barley at 37½cts. a bushel, and oats at 25cts. a bushel, will make a mixture worth 31cts. a bushel?

Ans. { 6 bush. at 50cts. 6 at 37½cts.
{ 25½ at 25cts.

7. A vintner would mix four sorts of wines together, of 18d. 20d. 24d. and 28d. a quart; what quantity of each must he take to sell the mixture at 22d. a quart?

Ans. 2qts. at 18d. 6 at 20d. 4 at 24d. 2 at 28d.

8. It is required to mix several sorts of wine, viz. at 9s., 15s., and 21s. a gallon, with water, that the mixture may be worth 12s. a gallon; how much of each sort must be taken?

Ans. { 3gals. at 9s., 3gals. at 15s., and 12gals.
{ at 21s., with 9gals. of water.

9. A grocer has several sorts of sugar, viz. one sort at 12cts. a lb., another at 11cts., a third at 9cts., and a fourth at 8cts. a lb.; how much of each sort must he take to make a mixture worth 10cts. a lb.?

1. *Ans.* { 2 at 12 / 1 at 11 / 1 at 9 / 2 at 8 }
2. *Ans.* { 3 at 12 / 2 at 11 / 2 at 9 / 3 at 8 }
3. *Ans.* { 1 at 12 / 2 at 11 / 2 at 9 / 1 at 8 }
4. *Ans.* { 1 at 12 / 3 at 11 / 3 at 9 / 1 at 8 }
5. *Ans.* { 3 at 12 / 1 at 11 / 3 at 9 / 2 at 8 }
6. *Ans.* { 2 at 12 / 3 at 11 / 1 at 9 / 3 at 8 }

7th. *Ans.* 3lb. of each sort

CASE 3.

When the price of all the simples, the quantity of one of them, and the mean price of the whole mixture are given, to find the several quantities of the rest.

RULE.

Link the several prices, and place their differences as in case 2; then,

As the difference opposite to the price of the given quantity,
Is to the differences respectively;
So is the given quantity,
To the several quantities required.

EXAMPLES.

11. A tobacconist determined to mix 20lb. of tobacco, at 15d. a lb. with other at 16d. a lb. 18d. a lb. and 22d. a lb.; how many pounds of each sort must he take to make one pound of that mixture worth 17d.?

17 { 15—5 / 16 1 / 18 1 / 22—2 }

As { 5 : 1 :: 20 : 4 at 16d. a lb. × 64
5 : 1 :: 20 : 4 at 18 × 72
5 : 2 :: 20 : 8 at 22 ×176
20 at 15 ×300

lb. d.
Proof As 36lb. : 612d. :: 1 : 17

12. A farmer would mix 20 bushels of wheat at 60cts. a bushel, with rye at 36cts., barley at 24cts., and oats at 8cts. a bushel; how much must he take of each sort to make the composition worth 32cts. a bushel?

Ans. 20 bush. of wheat, 60 bush. of rye, 70 bush. of barley, and 10 bush. of oats.

13. How much wine at 5s.; at 5s. 6d. and at 6s. a gallon, must

be mixed with 3 gallons at 4s. a gallon, so that the mixture may be worth 5s. 4d. a gallon?

Ans. 3gals. at 5s., 6 at 5s. 6d., and 6 at 6s.

14. A grocer would mix sugars, 12cts., 10cts., and 6cts., with 20lb. at 4cts. a lb. How much of each sort must he take to make the composition worth 8cts. a lb.?

Ans. 20lb. at 4cts. 10lb. at 6cts. 10lb. at 10cts. and 20lb. at 12cts.

CASE 4.

When the price of each simple, the quantity to be compounded, and the mean rate are given, to find how much of each sort will make the quantity.

RULE.

Link the several prices and place their differences as before; then,

As the sum of the differences,
Is to the difference opposite to each price,
So is the quantity to be compounded,
To the quantity required.

EXAMPLES.

15. How much sugar at 10cts. 12cts. and 15cts. a lb. will be required to make a mixture of 20lb. worth 13cts. a lb.?

13	10	2	2
	12	2	2
	15	3+1	4

8 sum of difference.

		Ans.	lb. Proof.
As 8	: 2 : :	20 :	5 at 10= 50
8	: 4 : :	20 :	10 at 15=150
8	: 2 : :	20 :	5 at 12= 60
		20 :	260 : : 1 : 13

16. A grocer having four sorts of tea, of 62cts., 75cts., $1, and $1 1/5 a lb., would have a composition of 87lb. worth 87cts. a lb.; what quantity must there be of each?

Ans. 15 3/5lb. at 62, 29 at 75, 29 at $1, 13 4/5 at $1 12cts.

17. A goldsmith has gold of 15, 17, 20, and 22 carats fine, and would melt together of each of these so much, as to make a mass of 40oz. of 18 carats fine; how much of each sort is necessary?

Ans. 16oz. of 15 carats, 8oz. of 17 carats, 4oz. of 20 carats, and 12oz. of 22 carats fine.

18. How many gallons of water must be mixed with wine, at

4s. a gallon, so as to fill a vessel of 80 gallons, that may be afforded at 2s. 9d. a gallon?

Ans. 25gals. of water, with 55gals. of wine.

Note.—By this case, is solved the famous question of the Crown of Hiero, King of Syracuse.

PROMISCUOUS EXAMPLES.

19. If I mix gold of 18 carats fine, with that of 23 carats fine, of 19 and of 16 carats fine, so that the composition may be 20 carats fine. What quantity of each must be taken?

Ans. 3 each of 16, 18, 19, and 7 of 23.

20. A vintner mingled 15 gallons of Canary, at $1 a gallon, with 20 gallons of Malaga, at 93cts. a gallon, with 10 gallons of Lisbon, at 76cts. and 24 gallons of French white wine at 50cts.: I demand the price of this mixture a gallon? *Ans.* $77\frac{7}{9}$cts.

21. A druggist had three sorts of indigo, one sort was worth 48 cents a lb. another 60cts. and another 96cts. and out of these he made up a parcel of 21lb. at 72cts. a lb. and another parcel of 35lb. at 84cts. a lb., how much of each sort did he put in each parcel?

Ans. { 6 at 48 / 6 at 60 / 9 at 96 } a lb. *Ans.* { 5 at 48 / 5 at 60 / 25 at 96 } a lb.

22. A merchant would mix 3 sorts of wine of different prices, viz. one at 6s. a gallon, another at 8s., a third at 11s., with 49 gallons, at 15s. a gallon, that the mixture may stand in 13s. a gallon; how much wine at 6s., 8s., and 11s., a gallon will it take.

Ans. 7 gallons of each sort.

POSITION.

Position is a rule for finding an unknown number, by one or more supposed numbers. It is of two kinds, Single and Double.

SINGLE POSITION.

Single Position teaches to resolve such questions as require only one supposition.

RULE.

Take any number and perform the same operations with it as are directed to be performed in the question; then,

As the result of the operation,
Is to the number given;
So is the supposed number,
To the number sought.

PROOF.

Work with the answer according to the directions given in the questions, and the result must equal the given number.

EXAMPLES.

1. A schoolmaster being asked how many scholars he had, said, if I had as many, half as many, and one quarter as many more, I should have 88. How many had he? *Ans.* 32

Suppose he had	40
as many	40
half as many	20
and ¼ as many	10
	110

as 110 : 88 : : 40

40

110)3520(32

3520

Proof.

32
32
16
8
88

2. Two men, A and B, having found a bag of money, disputed who should have it; A said the half, third, and fourth, of the money made 130 dollars: I demand how much was in the bag.

Ans. 120 dollars.

3. A, B, and C, bought a quantity of wine for 340 dollars, of which sum A paid three times more than B, and B four times more than C; how much did each pay?

Ans. A paid 240dols.; B 80dols.; and C 20dols.

4. A, B, and C, talking of their ages, B said his age was once and a half the age of A; C said his age was twice and one tenth the age of both, and that the sum of their ages was 93: what was the age of each? *Ans.* A's 12, B's 18, C's 63 years.

5. One being asked his age, replied, if ⅔ of the years I have lived be multiplied by 7, and ¼ of this product be divided by 3, the quotient will be 20; what was his age? *Ans.* 30.

6. A gentleman bought a chaise, horse, and harness for $270, the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness; what did he give for each? *Ans.* harness $30; horse $60; and chaise $180.

7. What sum, at 6 per cent. per annum, will amount to £860 in 12 years? *Ans.* £500.

DOUBLE POSITION.

Double Position is the method of resolving certain questions by means of two suppositions of false numbers.

RULE.

1. Take or assume any two convenient numbers, and proceed with each of them separately, according to the conditions of the question; and find how much each result is different from the result mentioned in the question, noting also whether the results are too great or too little.

2. Then multiply each of the said errors by the contrary supposition, namely, the first position by the second error, and the second position by the first error.

3. If the errors are alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer.

4. But if the errors are unlike, divide the sum of the products by the sum of the errors, for the answer.

Note.—The errors are said to be alike, when they are either both too great or both too little; and unlike, when one is too great and the other too little.

EXAMPLES.

8. B asked C how much his horse cost; C answered, that if he cost him three times as much as he did, and 15 dollars more, he would stand him in 300 dollars; what was the price of the horse? *Ans.* 95 dollars.

First Position	Second Position
90 suppose	96
3 times	3
270	288
15 add	15
285 result	303
300 true result	300
15 too little.	3 too much
	15
	18

90 96
×
15 3
96 90
90 270
135
1440
270
18)1710(95
162
90
90

95
3
285
15
300

Proof.

9. A, B, and C, would divide $100 between them, so that B may have $3 more than A, and C $4 more than B; I demand how much each man must have? *Ans.* A $30, B $33, C $37.

10. A man bequeathed £100 to three of his friends, after this manner: the first must have a certain portion, the second must have twice as much as the first, wanting £8; and the third must have three times as much as the first, wanting £15; I demand how much each man must have?

Ans. the first £20 10s.; second £33; third £46 10s.

11. The head of a certain fish is 9 inches long; its tail is as long as its head and half of its body; and the length of its body is equal to the length of its head and tail; what is the whole length? *Ans.* 6 feet.

12. A workman was hired for 40 days upon this condition, that

he should receive 20cts. for every day he wrought, and should forfeit 10cts. for every day he was idle; at settlement he received 5 dollars: How many days did he work, and how many days was he idle? *Ans.* wrought 30 days, idle 10.

13. A farmer having driven his cattle to market, received for them all $325: being paid for every ox 17\frac{1}{2}$, for every cow $12 50cts., and for every calf 3\frac{3}{4}$; there were twice as many cows as oxen, and three times as many calves as cows; how many were there of each sort? *Ans.* 5 oxen, 10 cows, 30 calves.

14. A person has two horses, and a saddle worth £50: now if the saddle be put on the back of the first horse it will make his value double that of the second; but if it be put on the back of the second, it will make his value tripple that of the first; what is the value of each horse? *Ans.* one £30 the other £40.

15. Two persons, A and B have both the same income; A saves one fifth of his every year; but B by spending 150 dollars per annum more than A, at the end of 8 years finds himself 400 dollars in debt. What was their income, and what does each spend per annum? *Ans.* { Their income is 500 dollars per annum. A spends 400 dollars, and B 550 dollars.

16. When first the marriage knot was ty'd
Between my wife and me,
My age was to that of my bride,
As three times three to three.
But now when ten, and half ten years
We man and wife have been,
Her age to mine exactly bears,
As eight is to sixteen;
Now tell, I pray, from what I've said,
What were our ages when we wed?
Ans. { Thy age, when marry'd, must have been Just forty-five; thy wife's fifteen.

INVOLUTION:

OR THE RAISING OF POWERS.

A power is the product arising from multiplying any given number into itself continually a certain number of times; thus,

$2\times2=4$ the second power or square of 2
$2\times2\times2=8$ the third power or cube of 2
$2\times2\times2\times2=16$ the fourth power of 2 &c.

The number denoting the power is called the *index* or *exponent* of that power.

If two or more powers are multiplied together, then the pro-

duct is that power whose index is the sum of the exponents of the factors; thus,

$2\times2=4$ the square of 2; $4\times4=16=$4th power of 2; and $16\times16=256=$8th power of 2, &c.

Root.	Square.	Cube.	4th power.	5th power.	6th power.	7th power.	8th power.	9th power.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

EXAMPLES.

1. What is the cube or third power of 4? *Ans.* 64.
   $4\times4\times4=64$
2. What is the fifth power of 7? *Ans.* 16807.
3. What is the cube or third power of 35? *Ans.* 42875.
4. What is the fourth power of $\frac{3}{4}$? *Ans.* $\frac{81}{256}$.
5. What is the fifth power of .029? *Ans.* .000000020511149.
6. What is the sixth power of 5.03? *Ans.* 16196.005304479729.

EVOLUTION:

OR, THE EXTRACTING OF ROOTS.

The root of any number or power, is such a number as being multiplied into itself a certain number of times will produce that power. Thus, 2 is the square root of 4, because 2×2 is 4; and 4 is the cube root of 64, because $4\times4\times4=64$, and so on.

THE SQUARE ROOT.

The square of a number is the product arising from a number multiplied into itself.

The extraction of the square root is the finding of such a number as being multiplied by itself, will produce the number proposed.

RULE.

1. Separate the given number into periods of two figures each, beginning at the units place.

2. Subtract from the first period at the left hand the greatest square it contains, setting the root of that square as a quotient figure, and doubling the said root for a divisor, and bring down the second period to the remainder for a dividual.*

* The *dividual* is a partial dividend, or so many of the dividend figures as are taken to be divided at one time, and which produces one quotient figure.

3. Try how often the said divisor, (with the figure used in the trial, thereto annexed) is contained in the dividual, and set this figure in both the divisor and root: then multiply and subtract as in division, and bring down the next period.

4. Double the ascertained root for a new divisor, and repeat the process to the end.

Note.—If there are decimals in the given number, point off the period both ways from the units place; and when the decimals do not consist of an even number of figures, annex a cypher. The root must have as many whole numbers and decimal figures as there are periods of each in the given number.

PROOF.

Square the root, adding in the remainder, if any, and the result will equal the given number.

EXAMPLES.

1. What is the square root of 30138.696025?

```
                . . . . . .
1  )30138.696025(173.605
1   1
---  ---
27)201
 7 189
-----  ---
343)1238
  3 1029
-----  -----
3466)20969
   6 20796
-----  -------
347205)1736025
       1736025
-------
```

2. What is the square root of 1296? Ans. 36.
3. What is the square root of 5499025? 2345.
4. What is the square root of 74770609? 8647.
5. What is the square root of 368863? 607.34092.+
6. What is the square root of 2.2710957? 1.50701.+
7. What is the square root of 10? 3.162277.+

8. What is the square root of .0003272481 ? *Ans.* .01809.
9. What is the square root of 9712.693809 ? 98 553.

TO EXTRACT THE SQUARE ROOT OF A VULGAR FRACTION.

RULE.

Reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

Note.—If the fraction be a surd, that is, one whose root can never be exactly found, reduce it to a decimal, and extract the root therefrom.

EXAMPLES.

10. What is the square root of $\frac{7}{9}\frac{2}{8}\frac{5}{1}\frac{6}{6}$? *Ans.* $\frac{7}{9}$.
11. What is the square root of $\frac{2}{4}\frac{7}{2}\frac{9}{3}\frac{4}{5}\frac{4}{6}$? $\frac{4}{5}$.
12. What is the square root of $\frac{4}{5}\frac{7}{0}\frac{8}{0}$? .93309.+
13. What is the square root of $\frac{3}{6}\frac{1}{1}\frac{6}{9}\frac{8}{2}$? .71628.+

TO EXTRACT THE SQUARE ROOT OF A MIXED NUMBER.

RULE.

Reduce the mixed number to an improper fraction, and proceed as in the foregoing examples; or,

Reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

14. What is the square root of $37\frac{7}{4}\frac{8}{9}$? *Ans.* $6\frac{1}{7}$.
15. What is the square root of $17\frac{1}{2}\frac{6}{5}$? $4\frac{1}{5}$.
16. What is the square root of $85\frac{1}{4}$? 9.27.+
17. What is the square root of $7\frac{9}{11}$? 2.796.+

APPLICATION.

18. A certain pavement is made exactly square, and each side of it contains 97 feet; I demand how many square feet are contained therein? *Ans.* 9409.

19. A certain square pavement contains 20736 square stones, all of the same size; what number is contained in one of its sides? *Ans.* 144.

20. A certain number of men gave $3 61cts. for a charitable purpose; each man gave as many cents as there were men; how many men were there? *Ans.* 19 men.

21. If 484 trees be planted in a square orchard, how many must there be in a row each way? *Ans.* 22.

Note.—The square of the longest side of a right angled triangle is equal to the sum of the squares of the other two sides: and consequently the difference of the square of the longest, and either of the other, is the square of the remaining one.

22. The wall of a certain fortress is 17 feet high, which is surrounded by a ditch 20 feet in breadth; how long must a ladder be to reach from the outside of the ditch to the top of the wall?
Ans. 26.24+ feet.

23. A line of 36 yards long will exactly reach from the top of a fort to the opposite bank of a river, known to be 24 yards broad; the height of the wall is required? *Ans.* 26.83+yards.

24. Suppose a ladder 60 feet long, be so planted as to reach a window 37 feet from the ground on one side of the street, and, without moving it at the foot, will reach a window 23 feet high on the other side; what was the breadth of the street? *Ans.* 102.64+ft.

25. If a pipe whose diameter is 1.5 inches, fill a cistern in 5 hours, in what time will a pipe, whose diameter is 3.5 inches fill the same? *Ans.* 54min. 36sec.

$1.5 \times 1.5 = 2.25$; and $3.5 \times 3.5 = 12.25$;

Then, as, 12.25 : 22.5 : : 5 : 91=54min. 36sec.

26. Admit a leaden pipe $\frac{3}{4}$ inch diameter, will fill a cistern in 3 hours; I demand the diameter of another pipe, which will fill the same cistern in one hour. *Ans.* 1.3 inches, nearly.

THE CUBE ROOT.

The Cube of a number is the product of that number multiplied into its square.

The extraction of the cube root is the finding of such a number, as being multiplied into its square, will produce the number proposed.

RULE.

1. Separate the given number into periods of three figures each, beginning at the units place. These periods will denote the number of figures the required root will contain.

2. Find the greatest root contained in the left hand period, which place to the right of the given number, subtract the cube of this root from the said period, and to the remainder bring down the next period for a dividual.

3. Square the root and multiply the square by 3 for a defective divisor.

4. Reserve mentally the units and tens of the dividual and try how often the defective divisor is contained in the rest: place the result of this trial to the root, and its square to the right of said divisor, supplying the place of tens with a cypher, if the square be less than ten.

5. Multiply the other figure or figures in the root by this last and by 30; add the product to the defective divisor and call it the complete divisor.

6 Multiply and subtract as in simple division, and bring down the next period for a new dividual, for which find a divisor as before, and so proceed with every period.

Note When there are decimals in the given number, separate the periods both ways from the units place, annexing as many cyphers to the decimal as may be deemed necessary. The root must consist of as many whole numbers and as many decimal figures, as there are periods of each in the given number.

PROOF.

Involve the root to the third power, adding the remainder, if any, to the result.

EXAMPLES.

1. What is the cube root of 444194.947 ?

Ans
76.8
343
101194
95976
5218947
0

Defect. div. & sqr. of 6=14736
+ 1260=complete div. 15996

Defect. div. and sqr. of 3=1732809
+6840=complete divis. 1739649

$7\times7\times3=147$ def. div.
$7\times6\times30=1260$ to complete the divisor.
$76\times76\times3=17328$ def. divisor.
$76\times3\times30=6840$ to complete the divisor.

2. What is the cube root of 34328125 ? *Ans.* 325.
3. What is the cube root of 99252.847 ? 46.3.
4. What is the cube root of 259694072 ? 638.
5. What is the cube root of 22069310125 ? 2805.
6. What is the cube root of 171.46776406 ? 5.555.+
7. What is the cube root of .001906624 ? .124.

NOTE 1.—The cube root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the numerator for a new numerator, and of the denominator for a new denominator. If it be a surd, extract the root of its equivalent decimal.

2. A mixed number may be reduced to an improper fraction or a decimal, and the root thereof extracted.

8. What is the cube root of $\frac{648}{3000}$? *Ans.* $\frac{3}{5}$.
9. What is the cube root of $\frac{3528}{11186}$? $\frac{2}{3}$.
10. What is the cube root of $12\frac{1}{27}$? $2\frac{1}{3}$.

SURDS.

11. What is the cube root of $\frac{1}{2}$? *Ans.* .763.+
12. What is the cube root of $7\frac{1}{2}$? 1.93.+
13. What is the cube root of 9^1 ? 2.092.+

APPLICATION.

14. Suppose a cellar to be dug, that shall be 12 feet every way, in length, breadth and depth ; how many solid feet of earth must be taken out to complete the same? *Ans.* 1728.

15. The content of a cubical piece of timber is 103823 solid inches; how many inches is it each way? *Ans.* 47.

16. A stone of a cubical form contains 474552 solid inches; what is the superficial content of one of its sides? *Ans.* 6084.

17. A merchant laid out £691 4s. in cloths, but forgot the number of pieces purchased, also how many yards were in each piece, and what they cost him a yard; but he remembers that they cost him as many shillings a yard as there were yards in each piece, and that there was just as many pieces: query, the number purchased? *Ans.* 24.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1. Point the given number into periods agreeably to the required root.

2. Find the first figure of the root by the table of powers, or by trial; subtract its power from the left hand period, and to the remainder bring down the first figure in the next period for a dividual.

3. Involve the root to the next inferior power to that which is given, and multiply it by the number denoting the given power, for a divisor; by which find a second figure of the root.

4. Involve the whole ascertained root to the given power, and subtract it from the first and second periods. Bring down the first figure of the next period to the remainder for a new dividend; to which, find a new divisor, as before, and so proceed.

Note.—The roots of the 4th, 6th, 8th, 9th and 12th powers, may be obtained more readily, thus:

For the 4th root, take the square root of the square root.
For the 6th, take the square root of the cube root.
For the 8th, take the square root of the 4th root.
For the 9th, take the cube root of the cube root.
For the 12th, take the cube root of the 4th root.

EXAMPLES.

1. What is the 5th root of 916132832?

916132832(62 *Ans.*
7776

6480)13853

$6\times6\times6\times6\times6=7776$
$6\times6\times6\times6\times5=6480$

916132832
916132832

$62\times62\times62\times62\times62=916132832.$

2. What is the Biquadrate-root or 4th power of 5624913456 1?
Ans. 487.
3. What is the 6th root of 782757789696? *Ans.* 96.
4. What is the 7th root of 194754273881? *Ans.* 41.
5. What is the 9th root of 1352605460594688? *Ans.* 48.

ARITHMETICAL PROGRESSION.

Any rank of numbers, increasing or decreasing by a common difference, is said to be an Arithmetical Progression: as,

{ 2, 4, 6, 8, 10, &c. is an ascending arithmetical series,
{ 6, 5, 4, 3, 2, 1, is a descending arithmetical series.

The numbers which form the series, are called the terms of progression. The first, and the last term are called the extremes.

NOTE. In any series of numbers, in Arithmetical Progression, the sum of the two extremes is equal to the sum of any two equally distant from them; as in the latter of the above series, $6+1=4+3$, and $5+2$.

When the number of terms is odd, the double of the middle term is equal to the sum of the two extremes, or any two terms equally distant from the middle term; as in the former of the foregoing series $6\times 2=2+10$, and $=4+8$.

In Arithmetical Progression five things are to be observed, viz.

First, the first term;
Secondly, the last term;
Thirdly, the number of terms;
Fourthly, the common difference;
Fifthly, the sum of all the terms;

Any three of which being given, the other two may be found.

CASE 1.

The First term, common difference, and number of terms given to find the last term, and the sum of all the terms.

RULE.

First, Multiply the number of terms, less 1, by the common difference, and to the product add the first term; the sum is the last term.

Secondly, Multiply the sum of the two extremes by the number of terms, and half the product will be the sum of all the terms.

EXAMPLES.

1. Bought 19 yards of shalloon, at 1d. for the first yard, 3d. for the second, 5d. for the third, &c. increasing 2d. for every yard; what did they amount to? *Ans.* £1 10s. 1d.

19	number of terms	37 }	two extremes
1		1 }	
18	num. of terms, less 1	38	
2	common difference	19	number of terms
36		342	
1	first term	38	
37	last term	2)722	
		12)361	sum of all the terms in pence
		2(0)3(0	1
		£1 10s. 1d.	*Ans.*

2. How many times does the hammer of a clock strike in twelve hours? *Ans.* 78 times.

3. Sixteen persons bestowed charity to a poor man, the first gave 5d.; the second 9d.; and so on in arithmetical progression; what did the last person give, and what sum did the indigent person receive?

Ans. the last gave 5s. 5d.; the sum received £2 6s. 8d.

4. A merchant sold 100 yards of cloth; for the first yard he received 12cts.; for the second 24cts.; for the third 36cts.; &c. what sum did he receive? *Ans.* $606.

5. If 100 stones be laid two yards distant from each other in a right line, and a basket be placed two yards from the first stone; what distance must a person travel, to gather them singly into the basket? *Ans.* 11m. 3fur. 180yd

6. A merchant sold 1000 yards of linen, at 2 pins for the first yard, 4 for the second, and 6 for the third; &c. increasing 2 pins every yard; how much did the linen produce when the pins were afterwards sold at 12 for a cent? *Ans.* $834 16cts.

CASE 2.

When the two extremes and number of terms are given, to find the common difference.

RULE.

Divide the difference of the extremes by the number of terms less one; the quotient will be the common difference.

EXAMPLES.

7. Admit a debt to be discharged at 16 several payments in arithmetical progression: the first to be $14, the last $74: wha

is the common difference, and what each payment, and the whole debt.

$$\left.\begin{matrix}\$\\74\\14\end{matrix}\right\}\text{extremes}$$

$$16-1=15)60(4 \text{ common diff.}$$
$$60$$

$
14 first payment.
4
18=second do.
4
22 third do. &c.

$14+74\times 8=\$704$ the whole debt.

8. There are 21 persons, whose ages are equally distant from each other; the youngest is 20 years old and the eldest 60; what is the common difference of their ages, and what the age of each person? *Ans.* common difference 2 years.

20 the age of the first person.
$20+2=22$ of the second.
$22+2=24$ of the third, &c.

9. A man had 10 sons, whose several ages differed alike; the youngest was 3 years old, and the eldest 48; what was the common difference of their ages? *Ans.* 5 years.

10. A person is to travel from New-York to a certain place in 16 days and to go but 4 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 79 miles, what is the common difference, and what the whole distance?

Ans. { Common difference 5 miles.
Distance 664 miles.

GEOMETRICAL PROGRESSION.

Geometrical Progression is a series of numbers increasing by a common multiplier, or decreasing by a common divisor; as 2, 4, 8, 16, 32, &c. or 32, 16, 8, 4, 2.

The number by which the series increase or decrease is called the ratio.

The sum of the series is found by this

RULE.

Raise the ratio to a power denoted by the number of terms, subtract 1, and multiply the remainder by the 1st term: this product divided by the ratio, less 1, gives the sum of the progression.

EXAMPLES.

1. A thrasher wrought 20 days, and received for the first day's hour 4 grains of wheat; for the second 12, for the third 36;

How much did his wages amount to, allowing 7680 grains to make a pint, and the whole to be sold for one dollar twenty-five cents a bushel?

Note.—The first term in this question is 4, the ratio 3, the number of terms 20; therefore raise the ratio to the 20th power

	1st power.	2d power.	3d power.	4th power.	5th power.	
Ratio	3,	9,	27,	81,	243	
					243	
					729	
					972	
					486	
					59049	tenth power.
					59049	
					531441	
					236196	
				531441		
				295245		
				3486784401		twentieth power.
					1	
				3486784400		
					4	first term.
Ratio less one				2)13947137600		
				7680)6973568800		sum of the series.
				64)908016		pints.
					14187	bushels.
					125	cents, value of 1 bushel.
					70935	
					28374	
					14187	
					$17733,75cts.	*Ans.*

2. Bought 30 bushels of wheat at 2d. for the first bushel, 4d. for the second, 8d. for the third, &c. what does the whole amount to, and what is the price a bushel on an average?

Ans. { £8947848 10s. 6d. amount.
£ 298261 12s. 4d. a bush.

3. What sum would purchase a horse with 4 shoes, and 8 nails in each shoe, at one cent for the first nail, two for the second, four for the third, &c. doubling to the last?

Ans. $42,949,672 95cts.

4. Admit a goldsmith sold one lb. of gold, at 1 cent for the first ounce, 4 cents for the second, 16 cents for the third, &c. in a quadruple proportion; what did it amount to? and what did he gain by it, supposing it cost him $14 an ounce?

Ans. { $55924 5cts. sold for.
$55756 5cts. gained.

5. A certain person had a daughter married on a new-year's day, and gave her an English guinea towards her portion, promising to double it on the first day of every month for one year. What was her portion in Federal money? *Ans.* $19110.

NOTE—$=4s. 6d.

6. If the posterity of Noah, which consisted of six persons at the flood, increased so as to double their number in 20 years, how many inhabitants were in the world two years before the death of Shem, who lived 502 years after the flood?

Ans. 201326586.

7. A grain of wheat being sown, produces 7 grains, which are sown again, and yield the same increase: Required how much it will amount to in 12 years, if the whole crop be always sown and yield the same increase; and how many bushels allowing as before for the number of grains in a pint?

Ans. { 2306881200 grains.
4693 bush. rejecting remainders.

8. Sold 30 yards of velvet, at 2 pins for the first yard, 6 for the second, 18 for the third, &c. and these were disposed of at one cent a hundred: how much did the velvet amount to? And whether did the seller gain or lose, and how much, supposing the prime cost of the velvet at $50 a yard?

Ans. { $20589113209 46cts.+amount.
$20589111709 46cts.+gained.

PERMUTATION.

Permutation is a rule for finding how many different ways any given number of things may be varied in their position.

RULE.

Multiply all the terms of the natural series continually from 1 to the given number inclusive; the last product will be the answer required.

EXAMPLES.

1. How many changes can be made of the three first letters of the alphabet?

$1\times2\times3=6$ *Ans.*

Proof.

1	a b c
2	a c b
3	b a c
4	b c a
5	c b a
6	c a b

2. How many different positions can 6 persons place themselves in at table? *Ans.* 720.

3. How many changes may be rung on 9 bells? *Ans.* 362880.

4. Seven gentlemen met at an inn, and were so well pleased with their host, and with each other, that they agreed to tarry so long as they, together with their host, could sit every day in a different position at dinner; how long must they have staid at said inn, to have fulfilled their agreement? *Ans.* $110\frac{172}{365}$ years.

COMBINATION.

Combination is a rule for discovering how many different ways a less number of things may be combined out of a greater; thus, out of the letters a, b, c, are three different combinations of two; viz. ab, ac, bc.

RULE.

Take a series, proceeding from and increasing by a unit, up to the number to be combined: and another series of as many places, decreasing by a unit, from the number out of which the combinations are to be made; multiply the former continually for a divisor, and the latter for a dividend; the quotient will be the answer.

Note.—Sums in this rule may be very much shortened by contraction.

EXAMPLES.

1. How many combinations of 5 letters in 10? *Ans.* 252.

$$\frac{10\times9\times8\times7\times6}{1\times2\times3\times4\times5}=252$$

Contracted.

$$\frac{\overset{2}{10}\times9\times\overset{2}{8}\times\overset{2}{6}\times6}{1\times2\times3\times4\times5}=252$$

2. How many combinations can be made of 6 letters out of 10? *Ans.* 210.

3. What is the value of as many different dozens as may be chosen out of 24, at 1d. a dozen? *Ans.* £11267 6s. 4d.

QUESTIONS IN ALLIGATION.

What is Alligation?

When the several quantities and their prices are given, how is the mean price of any part of the composition found?

How are the simples with the mean rate placed in order to be linked?

How should the rates be linked with each other?

How is the difference between each rate and the mean rate set down?

What is the difference thus found?

When all the given rates are greater or less than the mean rate, how must they be linked?

When the questions are differently linked what do they produce?

When the price of all the simples, the quantity of one of them, and the mean price of the whole mixture are given, how are the several quantities of the rest found?

When the price of each simple, the quantity to be compounded, and the mean rate are given, how do we find how much of each sort will make the quantity?

QUESTIONS IN POSITION.

What is Position?

How many kinds of position are there?

What is single position?

What is the rule for working sums in single position?

What is double position?

What is the first step taken in double position?

What is done with the positions and their errors?

When the errors are alike, how is the answer found?

And how is it found when the errors are unlike?

What is understood by the errors being alike or unlike?

QUESTIONS IN THE SQUARE ROOT.

What is the Involution or raising of powers?
What is the index or exponent of a power?
What is understood by the root of any power?
What is the square of a number?
In extracting the Square Root, what is first done?
What then are the several steps taken to find the Root?
What is the dividual?
When there are decimals in the given number, how are the periods pointed off?
What proportion is there between the number of figures in the quotient, and the number in the dividend?
How is the Square Root proved?
How is the Square Root of a Vulgar Fraction extracted?
What is a Surd?
How is the Square Root of a Surd extracted?
How is the Square Root of a mixed number extracted?

QUESTIONS IN THE CUBE ROOT.

What is the cube of a number?
What is understood by the cube root of a number?
What is first done in extracting the cube root? and then what are the different steps taken?
How is the given number separated into periods when part is decimals?
How many figures must there be in the root?
How is the cube root proved?
How is the cube root of a vulgar fraction found?
How is a vulgar fraction extracted, when it is a surd?
How is the root of a mixed number extracted?

COMPOUND INTEREST, BY DECIMALS.

The ratio in compound interest is the amount of one pound or dollar for one year, which is thus found:

As 100 : 1 :: 105 : 1.05. As 100 : 1 :: 105·5 : 1.055.

The principal, time, and rate given, to find the amount, or interest.

RULE.

Multiply the principal by the ratio involved to the time, and the product will be the amount: from which subtract the principal, for the compound interest.

EXAMPLES.

1. What will $225 amount to in 3 years at 5 per cent. per ann.

1.05×1.05×1.05=1.157625 raised to the third power; then, 1.157625×225=$260 46cts. 5m. 625 the *Ans.*

2. What is the amount of $760 50cts. for 4 years at 4 per cent. per annum? *Ans.* $889 67cts.+

3. What is the compound interest of $509 for 4 years at 5 per cent. per annum? *Ans.* $109 69cts. 2m.+

4. What will £480 amount to in 6 years at 5 per cent. per annum? *Ans.* £643 4s. 11d.

DISCOUNT.

AT COMPOUND INTEREST.

The amount, rate and time given, to find the principal.

RULE.

Divide the amount by the ratio involved to the time.

EXAMPLES.

1. What principal must be put to interest to amount to $260.465625 in 3 years, at 5 per cent. per annum?

1.05×1.05×1.05=1.157625 ratio raised to the third power.

1.157625)260.465625(225 Dols. *Ans.*

2. What principal will amount to $547.4938050, in 5 years, at 4 per cent. per annum? *Ans.* $450.

3. What principal will amount to $619.4123, in 4 years, at 5¼ per cent. per annum? *Ans.* $500.

DUODECIMALS.

Duodecimals are fractions of a foot, or of an inch, or parts of an inch, &c. having 12 for their denominator.

The denominations are foot, inch, second, thirds and fourths,

12 fourths''''	make	1 third'''
12 thirds		1 second''
12 seconds		1 inch I.
12 inches		1 foot ft.

Addition and subtraction in duodecimals are performed in the same manner as in compound addition and subtraction.

MULTIPLICATION OF DUODECIMALS.

CASE 1.

When the feet of the multiplier do not exceed 12

RULE.

Set the feet of the multiplier under the lowest denomination of the multiplicand, as in the following example; these multiply as in compound multiplication, by each denomination of the multiplier separately, observing to place the right hand figure, or number, of each product, under that denomination of the multiplier by which it is produced.

Note 1.—If there are no feet in the multiplier supply their place with a cypher; and in like manner supply the place of any other denomination between the highest and lowest.

Note 2.—Feet multiplied by feet, give feet.
Feet multiplied by inches, give inches.
Feet multiplied by seconds, give seconds.
Inches multiplied by inches, give seconds.
Inches multiplied by seconds, give thirds.
Seconds multiplied by seconds, give fourths.

EXAMPLES.

1. Multiply 10 Ft. 6 I. by 4 Ft. 6 In.

Ft. In.	In.	Or thus,	F. I. Or decimally.
10 : 6	6 | ½ |	10 : 6	10 : 6 = 10.5
4 : 6		4 : 6	4 : 6 = 4.5
5 : 3 : 0		42 : 0	525
42 : 0		5 : 3	420
47 : 3 : 0		47 : 3	47.25

	Ft. I. "	Ft. In. "	Ft. I. "
2. Multiply	9 : 7 : 0	by 3 : 6 : 0	*Ans.* 33 : 6 : 6
3. ———	3 : 11 : 0	by 9 : 5 : 0	36 : 10 : 7
4. ———	8 : 6 : 9	by 7 : 3 : 8	62 : 6 : 7 : 9
5. ———	28 : 10 : 6	by 3 : 2 : 4	92 : 2 : 10 : 6

CASE 2.

When the feet of the multiplier exceed 12.

RULE.

Multiply by the feet of the multiplier as in compound multiplication, and take parts for the inches, &c.

EXAMPLES.

6. Multiply Ft. I. " 311 4 7 by Ft. I. " 36 7 5

6 × 6 = 36

1868 3 6
6

I. 6 = ½ 11209 9 0
1 = 1/6 155 8 3 6
" 4 = 1/3 25 9 8 7
1 = ¼ 8 7 2 10 4
2 1 9 8 7

Product. 11402 0 0 7 11

	Ft.	I.	"		Ft.	I.	"		Ft.	I.	"	"
7. Multiply	76	7	0	by	19	10	0	*Ans.*	1518	10	10	0
8. ———	84	3	0	by	95	2	0		8017	9	6	0
9. ———	84	7	11	by	76	3	9		6460	7	1	8

APPLICATION.

Note.—Divide the square feet by 9, and the quotient will be square yards.

10. What will the plastering of a ceiling at 10cts. a yard, come to supposing the length 21 feet 8 inches, and the breadth 14 feet 10 inches? *Ans.* $3 57cts.

11. What will the paving of a court yard come to, at 4¼d. a yard, the length being 58 feet 6 inches, and the breadth 54 feet 9 inches? *Ans.* £7 0s. 10d.

12. Suppose the dimensions of a load of bark or wood to be 7 feet 6 inches long, 3 feet 3 inches wide, and 1 foot 10 inches high; what is the solid content? *Ans.* 44ft. 8in. 3″.

PROMISCUOUS QUESTIONS TO EXERCISE THE LEARNER IN THE FOREGOING RULES.

1. There are in three bags, the sum of 1468 dollars, viz. in the first bag 461 dollars, in the second 581 dollars. I demand what number of dollars is in the third bag? *Ans.* $426.

2. What difference is there between twice five and twenty; and twice twenty-five? *Ans.* 20.

3. If $100 principal gain $5 interest in 12 months; what principal will gain $20 in 8 months? *Ans.* $600.

4. How many yards of cloth, at $1 23cts. a yard, can I have for 13cwt. 2qr. of wool, at 14cts. a lb.? *Ans.* 172yd. +

5. A, B, and C traded together; the first put in I know not how much, B put in 20 pieces of cloth, and C put in $500, and they gained $1000, whereof A ought to have $350 and B $400; I demand C's share, how much the first man put in, and what the 20 pieces of cloth were worth? *Ans.* C's share was $250, A put in $700, and B's cloth was worth $800.

6. Jacob, by contract, was to serve Laban for his two daughters 14 years; and when he had accomplished 11 years, 11 months, 11 weeks, 11 days, 11 hours, and 11 minutes; how long had he to serve? *Ans.* 1y. 11m. 3w. 2d. 12h. 49m.

7. If a man leave 6509 dollars to his wife and two sons, thu to his wife ⅜, to his elder son ⅖ of the remainder, and his oth son the rest; what will be the share of each?

Ans. { His wife's $2440 87½cts. / Elder son's $2440 87½cts. / Other son's $1627 25cts.

8. There are 7 chests of drawers, in each chest there are 18 drawers, and in each drawer there are six divisions, in each division there are £16 6s. 8d.; how much money is there in the whole? *Ans.* £12348.

9. There is a certain number, which, being divided by 7, the quotient resulting multiplied by 3, that product divided by 5 from the quotient 20 being subtracted, and 30 added to the remainder, the half sum shall make 65; what is that number? *Ans.* 1400.

10. The circular Winchester bushel is 18½ inches over, and 8 inches deep. How many bushels of grain will a square bin hold, that is 7 feet 10 inches long, 3 feet 10 inches broad, and 4 feet 2 inches deep, within? *Ans.* 100¼ bushels.+

11. A young man received $210 which was ⅔ of his elder brother's portion; now three times the elder brother's portion was half of the father's estate; how much was the estate worth? *Ans.* $1890.

12. A man had 12 sons; the youngest was 3 years old, and the eldest 58; they increased in arithmetical progression; what was the common difference of their ages? *Ans.* 5 years.

13. If I buy a yard of cloth for $1 87½cts., and sell it for $2 15cts., what do I gain per cent.? *Ans.* $14 66cts. 6m.+

14. How many dollars are equal to 980 French crowns? *Ans.* $1078.

15. Bought 27 bags of ginger, each weighing gross 84¾lb. tare 1⅝lb. per bag, tret 4lb. on 104lb.; what does the whole (neat weight) come to, at 8½d. a lb.? *Ans.* £76 13s. 2½d.+

16. If the human heart beat 70 times in a minute, and each pulsation transmit 4oz. (Avoirdupois) of blood, and the whole blood be $\frac{1}{27}$ part of the weight of the body; in what time will the whole blood of a man, whose weight is 140lb. circulate through the heart? *Ans.* in 24sec.

17. Divide 1200 acres of land among A, B, and C, so that B may have 100 more than A, and C 64 more than B. *Ans.* A 312, B 412, and C 476.

18. A person dying, left his widow $1780, and $1250 to each of his 4 children; he had been 25½ years in trade, and had cleared (at an average) $126 a year; what had he to begin with? *Ans.* $3567.

19. How many trees may be planted on an acre of ground at the distance of 6 feet from each other? *Ans.* 1210.

20. If a cow yield 20 quarts of milk in a day for 240 days, and 25 quarts make 1lb. of butter, how many lbs. butter will be obtained in the season, and what does it come to at 15 cents a lb. *Ans.* 192lb. $28 80cts.

21. A grocer buys sugar, at $9 54cts. a cwt. at what rate

cwt. must he sell it in order to gain 5 per cent. and at what rate a lb. in order to gain 10 per cent.?

Ans $10 1ct. 7m.+ a cwt. and 9cts. 3m+ a lb.

22. Admitting the Hudson river to be 1000 feet broad, and 10 feet deep, and to run at the rate of 4 miles in an hour, in what time will it discharge a cubic mile of water (reckoning 5000 feet to the mile) into the sea? *Ans.* 26 days, 1 hour.

23. If A can do a piece of work alone in 8 days, B in 12 days and C in 16 days; in what time will all three finish it working together? *Ans.* $3\frac{9}{13}$ days.

First, Suppose the work to be divided into 48 parts.

	days.	days.	parts.	parts.	
Then say as	8	: 1 : :	48	: 6=	the num. that A can do in 1 day
	12	: 1 : :	48	: 4=	do. B do.
	16	: 1 : :	48	: 3=	do. C do.
				13	the number of parts performed by all three in one day.

	parts.	parts.	day.	
Again As	13	: 48	: : 1 :	$3\frac{9}{13}$ day. *Ans.*

Note—In questions of this kind, suppose the work to consist of any number of parts that may be divided without remainders, by the different times in which the different persons are to perform the work, and proceed agreeably to the tenor of the question.

24. A and B together can build a boat in 20 days; with the assistance of C, they can do it in 12; in what time would C do it by himself? *Ans.* 30 days.

25. A can do a piece of work alone in 13 days, and A and B together in 8 days; in what time can B do it alone? *Ans.* $20\frac{4}{5}$ days.

26. A, B, and C, can complete a piece of work in 15 days, A can do it alone in 30 days, and B in 40; in what time can C do it by himself? *Ans.* 120 days.

27. In a certain orchard $\frac{1}{2}$ of the trees bear apples, $\frac{1}{4}$ pears, $\frac{1}{8}$ plums, 60 of them peaches, and 40 cherries; how many trees are in the orchard? *Ans.* 1200.

28. A person, willing to distribute some money among a number of beggars, wanted 8cts. to give them 3cts. a piece; he therefore gave each 2cts. and had 3cts. left, how many beggars were there? *Ans.* 11.

29. A guardian paid his ward $3500, for $2500 which he had held in his possession 8 years; what rate of interest did he allow him? *Ans.* 5 per cent.

30. A stone is 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches thick, how many solid feet does it contain?

Ans. 41 feet 3 inches.

31. A room, 30ft. long, and 18ft. wide, is to be covered with painted cloth, how many yards $\frac{3}{4}$ wide will cover it? *Ans.* 80.

32. If I buy 100 yards of ribbon, at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, do I gain or lose, and how much? *Ans.* lose 3s. 4d.

33. There is a mast or pole, $\frac{1}{3}$ of its length stands in the ground, 12 feet of it in the water, and $\frac{2}{5}$ of its length in the air, or above water; how much is the whole length? *Ans.* 216 feet.

34 The hour and minute hands of a watch are exactly together at 12 o'clock, when are they next together?

The velocities of the two hands of a watch or clock, are to each other, as 12 to 1; therefore the difference of velocities is 12 —1=11.

$$\text{As } 11 : \left\{\begin{matrix}12\times1\\12\times2\end{matrix}\right\} :: 1 : \left\{\begin{matrix}1\ \ 5\ \ 27\frac{3}{11}.\\2\ \ 10\ \ 54\frac{6}{11}.\end{matrix}\right\} \textit{Ans.}\ \&c.$$

35. A person being asked the hour of the day, said the time past noon is equal to $\frac{1}{3}$ of the time till midnight; what was the time? *Ans.* 20 minutes past 5.

36. If the earth be 360 degrees in circumference, and each degree 69½ miles, how long would a man be in travelling round it who should travel 20 miles each day, reckoning 365¼ days in a year? *Ans.* 3 years 155¼ days.

37. At the close of the American war the British government owed £280,000,000 and the pound sterling contains 3oz. 17dwt. 10gr. of silver; I demand the number of tons Avoirdupois, 7000 grains Troy being equal to one pound Avoirdupois; I likewise wish to know how long a string of wagons it would take to carry the whole, a ton at a load, and 3 rods apart?

Ans. { Wt. 33178T. 11cwt. 1qr. 20lb.
Distance 311 miles, 14rods.

38. A and B traded together; A put in $320 for 5 months, B $460 for 3 months, and they gained $100; what was each man's share of the gain?

Ans. { A's share is $53 69cts. 1m.+
B's—— is $46 30cts. 8m.+

39 Shipped to Jamaica 550 pair of stockings, at $1 40cts. a pair, and 460 yards of stuffs at 14cts. a yard; in return for which I have received 46cwt. 3qr. of sugar, at $3 6cts. a cwt. and 1570lb. of indigo, at 29cts. a lb.; what remains due to me?

Ans. $236 4cts. 5m.

40. The accounts of a certain school are as follows; viz. $\frac{1}{10}$ of the boys learn geometry, $\frac{1}{3}$ learn grammar, $\frac{3}{10}$ learn arithmetic, $\frac{3}{20}$ learn to write, and 9 learn to read; what number is there of each?

Ans. { 5 learn geometry, 30 grammar, 24 arithmetic, 12 writing, and 9 reading.

41. A lets B have a hogshead of sugar weighing 18cwt. worth $5, for $7 the cwt.; $\frac{1}{3}$ of which he is to pay in cash; B has paper worth $2 the ream, which he gives A for the rest of his sug-

gar at $2½ the ream; which gained the most by the bargain?
Ans. A by $19 20cts.

42. A stationer sold quills at 11s. a thousand, by which he cleared ⅔ of the money; but growing scarce, he raised them to 13s. 6d. a thousand; what did he gain per cent. from the prime cost by the latter price? *Ans.* £96 7s. $3\frac{3}{11}$d.

43. A man gave to his three sons all his estate in money; viz. to F half, wanting $50, to G one third, and to H the rest, which was $10 less than the share of G; I demand the sum given, and each man's part? *Ans.* The sum given was $360 whereof F had $130, G $120, and H $110.

44. A gentleman divided his fortune among his three sons, giving A £9 as often as B £5 and to C but £3 as often as B £7 and yet C's dividend was £2584; what was the whole estate?
Ans. £19466 2s. 8d.

45. A father left his two children, John and James (John 11 and James 16 years old) $10000 to be divided so that each share, being put to interest at 7 per cent. might amount to equal sums when they should be respectively 21 years of age. Required the shares.
Ans. { John's share 4426\frac{14}{17}$. James' share 5573\frac{3}{17}$.

46. What is the difference between six dozen dozen, and a half a dozen dozen? *Ans.* 792.

47. Three persons purchased together a ship, toward the payment of which A advanced ⅘ and B ⅔ of the value, and C £200, how much paid A and B, and what part of the vessel had C?
Ans. A £90$\frac{2}{3}$, B £116$\frac{4}{3}$, and C $\frac{31}{45}$ part.

48. Laid out in a lot of muslin, £480 11s. upon examination of which, 2 parts in 7 proved damaged; so that I could make but 5s. 6d. a yard of the same, and by so doing, I lost £49 6s. by it; at what rate an ell English, am I to part with the undamaged muslin to make up said loss? *Ans.* 12s. $3\frac{33}{160}$d.

49. A water tub holds 147 gallons; the pipe usually brings in 14 gallons in 9 minutes, the tap discharges at a medium 40 gallons in 31 minutes; now, supposing the tap to be carelessly left open, and the water to be turned on at 2 o'clock in the morning; a servant at 5 finding the water running, shuts the tap, and is solicitous to know in what time the tub will be filled after this accident. *Ans.* the tub will be full at 3min. 48+sec. after 6.

50 Twenty knights, 30 merchants, 24 lawyers, and 24 citizens, spent at a dinner, £64 which sum was divided among them in such a manner that 4 knights paid as much as 5 merchants; 10 merchants as much as 16 lawyers, and 8 lawyers as much as 12 citizens; the question is to know the sum of money paid by all the knights; also by the merchants, lawyers, and citizens?

Ans 20 knights paid £20, the 30 merchants £24, the 24 lawyers £12, and the 24 citizens £8.

51. The yearly interest of Harriet's money, at 6 per cent. exceeds $\frac{1}{20}$ of the principal by a £100 and she does not intend to marry any man who is not scholar enough to tell her fortune; pray what is it? *Ans.* £10000.

52. A gentleman left his son a fortune; $\frac{5}{16}$ of which he spent in 3 months; $\frac{3}{4}$ of $\frac{5}{8}$ of the remainder lasted him 9 months longer, when he had only £537 left; what did the father bequeath him?

Ans. £2082 18s. $2\frac{3}{11}$d.

53. There are three horses, belonging to different men, employed to draw a load from Poughkeepsie to Hartford for 35 dollars, A and B are supposed to do $\frac{3}{11}$ of the work, A and C $\frac{5}{13}$ and B and C $\frac{2}{7}$ of it. They are paid proportionally; please to divide their pay for them as it should be.

Ans. A $13 79+
B 6 45+
C 14 75+

54. A hare starts 12 rods before a hound; but is not perceived by him until she has been up 45 seconds; she scuds away at the rate of 10 miles an hour, and the dog on view, makes after, at the rate of 16 miles an hour: how long will the course hold, and what space will be run over, from the spot where the dog started?

Ans. Distance 2288 feet.
Time $97\frac{1}{2}$ seconds.

55. There are two columns in the ruins of Persepolis left standing upright; one is 64 feet above the plain, the other fifty. Between these, in a right line stands an ancient statue, the head whereof is 97 feet from the summit of the higher, and 86 feet from the top of the lower column, and the distance between the lower column and the centre of the statue's base is 76 feet; required the distance between the top of the columns.

Ans. If the statue be lower than the columns then the distance between their tops will be 157+ feet. But if the statue be higher, then their distance will be 169.95+ feet.

56. Hiero, king of Sicily, ordered his jeweller to make him a crown, containing 63 ounces of gold. The workman thought that substituting part silver was only a proper perquisite; which taking air, Archimedes was appointed to examine it; who, on putting it into a vessel of water, found it raised the fluid 8.2245 cubic inches: and having discovered that the inch of gold weighed 10.36 ounces, and that of silver but 5.85 ounces, he found by calculation what part of the king's gold had been changed. Repeat the process, and inform us what part of it was gold and what silver.

Ans. 34oz. 3dwt. $22\frac{1}{2}$gr. gold.
28oz. 16dwt. $1\frac{1}{2}$gr. silver.

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